ERDAS IMAGINE® Advantage

Tour Guides

November 2009

erdas
The Earth to Business Company

Copyright © 2009 ERDAS, Inc.

All rights reserved.

Printed in the United States of America.

The information contained in this document is the exclusive property of ERDAS, Inc. This work is protected under United States copyright law and other international copyright treaties and conventions. No part of this work may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or by any information storage or retrieval system, except as expressly permitted in writing by ERDAS, Inc. All requests should be sent to the attention of:

Manager, Technical Documentation
ERDAS, Inc.
5051 Peachtree Corners Circle
Suite 100
Norcross, GA 30092-2500 USA.

The information contained in this document is subject to change without notice.

Government Reserved Rights. MrSID technology incorporated in the Software was developed in part through a project at the Los Alamos National Laboratory, funded by the U.S. Government, managed under contract by the University of California (University), and is under exclusive commercial license to LizardTech, Inc. It is used under license from LizardTech. MrSID is protected by U.S. Patent No. 5,710,835. Foreign patents pending. The U.S. Government and the University have reserved rights in MrSID technology, including without limitation: (a) The U.S. Government has a non-exclusive, nontransferable, irrevocable, paid-up license to practice or have practiced throughout the world, for or on behalf of the United States, inventions covered by U.S. Patent No. 5,710,835 and has other rights under 35 U.S.C. § 200-212 and applicable implementing regulations; (b) If LizardTech's rights in the MrSID Technology terminate during the term of this Agreement, you may continue to use the Software. Any provisions of this license which could reasonably be deemed to do so would then protect the University and/or the U.S. Government; and (c) The University has no obligation to furnish any know-how, technical assistance, or technical data to users of MrSID software and makes no warranty or representation as to the validity of U.S. Patent 5,710,835 nor that the MrSID Software will not infringe any patent or other proprietary right. For further information about these provisions, contact LizardTech, 1008 Western Ave., Suite 200, Seattle, WA 98104.

ERDAS, ERDAS IMAGINE, IMAGINE OrthoBASE, Stereo Analyst and IMAGINE VirtualGIS are registered trademarks; IMAGINE OrthoBASE Pro is a trademark of ERDAS, Inc.

SOCET SET is a registered trademark of BAE Systems Mission Solutions.

Other companies and products mentioned herein are trademarks or registered trademarks of their respective owners.

Table of Contents

Table of Contents v

List of Tables ix

Preface xi

About This Manual . . . . **xi**

Example Data . . . . **xi**

Time Required . . . . **xi**

Documentation . . . . **xi**

Conventions Used in This Book . . . . **xii**

Getting Started . . . . **xiii**

ERDAS IMAGINE Icon Panel xiii
ERDAS IMAGINE Menu Bar xiii
Dialogs xxi

More Information/Help . . . . **xxi**

Fourier Transform Editor 1

Introduction **1**

Create an .fft Layer **1**

Display Source File 1
Create FFT Output File 3

Start the Fourier Transform Editor **4**

Edit Using Menu Options **7**

Use Low-Pass Filtering 7
Select a Different Filter 8
Save the File 9
Apply an Inverse Fourier Transformation 9
Apply Other Filters 11
Use a Circular Mask 14
Use a Rectangular Mask 16
Use a Wedge Mask 17

Edit Using Mouse-Driven Tools **19**

Use Low-Pass Filtering 20
Use High-Pass Filtering 20
Apply a Wedge Mask 22
Combine Edits 23

Image Interpreter 25

Introduction **25**

Subsetting an Image **25**

Selecting an AOI to Subset 26
Subsetting an Image Without Snapping 27
Displaying the Subset with the Original Data 30
Subsetting an Image With Snap to Raster 31
Viewing the Snapped Subset 32

Apply Spatial Enhancement 33
Apply Convolution 34
Select Input/Output Files 35
Select Kernel 35
Check the File 36
Apply Crisp 37
Use the View Option 38
View Results 40

Apply Radiometric Enhancement 40
Apply Brightness Inversion 41
Reverse 42
View Changes 42

Apply Spectral Enhancement 44
Use Tasseled Cap 44
Check Results 46
Use the Indices Function 47
Choose RGB to IHS 48
Choose IHS to RGB 49
View the Results 50

Wavelet Resolution Merge 52

Orthorectification 57

Introduction 57

Rectify a Camera Image 57
Perform Image to Image Rectification 57
Prepare 58
Review Image Information 60
Check for Map Model 60
Redisplay the file 61
Perform Geometric Correction 61
Set Camera Model Properties 62
Edit Fiducials 63
Enter Film Coordinates 66
Change Projection 68
Name the Geometric Model 70
Start the GCP Tool and compute RMS Error 70
Choose Your Path 72
Resample the Image 73
Calibrate the Image 74

Terrain Surface Interpolation 77

Introduction 77

Create a Surface 77
Import an ASCII File 78
Perform Surfacing 81
Display the Surface 82

MosaicPro 85

Introduction 85

Mosaic Using Laguna Beach Images. 85
Starting MosaicPro 85
Adding and Displaying Images in MosaicPro 87
Drawing and Editing Seam Polygons 90
Correcting Color 91
Image Dodging 93
Previewing the Mosaic 95
Setting Seamline Functions 96
Defining the Output Images 96
Running the Mosaic 97
Displaying the Mosaic 97

Viewshed Analysis 99

Introduction 99
Create a Viewshed 99
Add the Raster Image 100
Start Image Drape Viewer and Set Level of Detail 100
Start the Viewshed Analysis Tool 101
Add First Observer 103
Add Another Observer 104
Link the Viewers and Set Eye and Target Positions 106
Save the Viewshed 108
Query Viewshed Data 108
Add Area Column to the CellArray 110
Query the Viewshed Layer 111
Finish 111

Index 113

List of Tables

Table 1: Session Menu Options xiv
Table 2: Main Menu Options xvi
Table 3: Tools Menu Options xvii
Table 4: Utility Menu Options xix
Table 5: Help Menu Options xx
Table 6: Film X and Film Y Coordinates 66

Preface

About This Manual

The *ERDAS IMAGINE Advantage Tour Guide* manual is a compilation of tutorials designed to help you learn how to use ERDAS IMAGINE® software. This is a comprehensive manual, representing ERDAS IMAGINE and its add-on modules. Each guide takes you step-by-step through an entire process. The tour guides are not intended to tell you everything there is to know about any one topic, but to show you how to use some of the basic tools you need to get started.

This manual serves as a handy reference that you can refer to while using ERDAS IMAGINE for your own projects. Included is a comprehensive index, so that you can reference particular information later.

There are two other ERDAS IMAGINE Tour Guides™ manuals. They are based on the way ERDAS IMAGINE is packaged. These manuals take you through IMAGINE in a step-by-step fashion to learn detailed information about the various ERDAS IMAGINE functions. The other ERDAS IMAGINE Tour Guides manuals are:

- IMAGINE Essentials®
- IMAGINE Professional®

Example Data

Sample data sets are provided with the software. This data is separately installed from the data DVD. For the purposes of documentation, <ERDAS_Data_Home> represents the name of the directory where sample data is installed. The Tour Guides refer to specific data which are stored in <ERDAS_Data_Home>/examples.

Time Required

Each individual tour guide takes a different amount of time to complete, depending upon the options you choose and the length of the tour guide. The approximate completion time is stated in the introduction to each tour guide.

Documentation

This manual is part of a suite of on-line documentation that you receive with ERDAS IMAGINE software. There are two basic types of documents, digital hardcopy documents which are delivered as PDF files suitable for printing or on-line viewing, and On-Line Help Documentation, delivered as HTML files.

The PDF documents are found in <IMAGINE_HOME>\help\hardcopy. Many of these documents are available from the ERDAS Start menu. The on-line help system is accessed by clicking on the **Help** button in a dialog or by selecting an item from a Help menu.

Conventions Used in This Book

In ERDAS IMAGINE, the names of menus, menu options, buttons, and other components of the interface are shown in bold type. For example:

“In the Select Layer To Add dialog, select the **Fit to Frame** option.”

When asked to use the mouse, you are directed to click, Shift-click, middle-click, right-click, hold, drag, etc.

- click—designates clicking with the left mouse button.
- Shift-click—designates holding the Shift key down on your keyboard and simultaneously clicking with the left mouse button.
- middle-click—designates clicking with the middle mouse button.
- right-click—designates clicking with the right mouse button.
- hold—designates holding down the left (or right, as noted) mouse button.
- drag—designates dragging the mouse while holding down the left mouse button.

The following paragraphs are used throughout the ERDAS IMAGINE documentation:

These paragraphs contain strong warnings.

These paragraphs provide software-specific information.

These paragraphs contain important tips.

These paragraphs lead you to other areas of this book or other ERDAS® manuals for additional information.

NOTE: Notes give additional instruction.

Shaded Boxes

Shaded boxes contain supplemental information that is not required to execute the steps of a tour guide, but is noteworthy. Generally, this is technical information

Getting Started

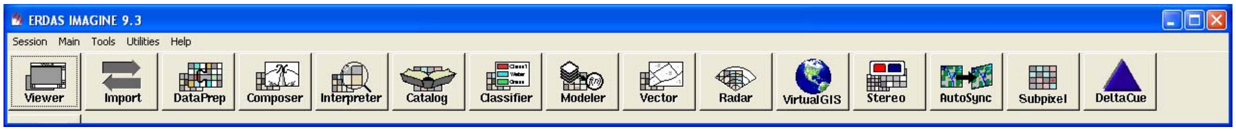
To start ERDAS IMAGINE, in Microsoft Windows navigate to **ERDAS IMAGINE [version]** from the **Start** menu, or type the following in a UNIX command window: **imagine**.

ERDAS IMAGINE begins running; the icon panel automatically opens.

ERDAS IMAGINE Icon Panel

The ERDAS IMAGINE icon panel contains icons and menus for accessing ERDAS IMAGINE functions. You have the option through the **Session -> Preferences** menu to display the icon panel horizontally across the top of the screen or vertically down the left side of the screen. The default is a horizontal display.

The icon panel that displays on your screen looks similar to the following:



The various icons that are present on your icon panel depend on the components and add-on modules you have purchased with your system.

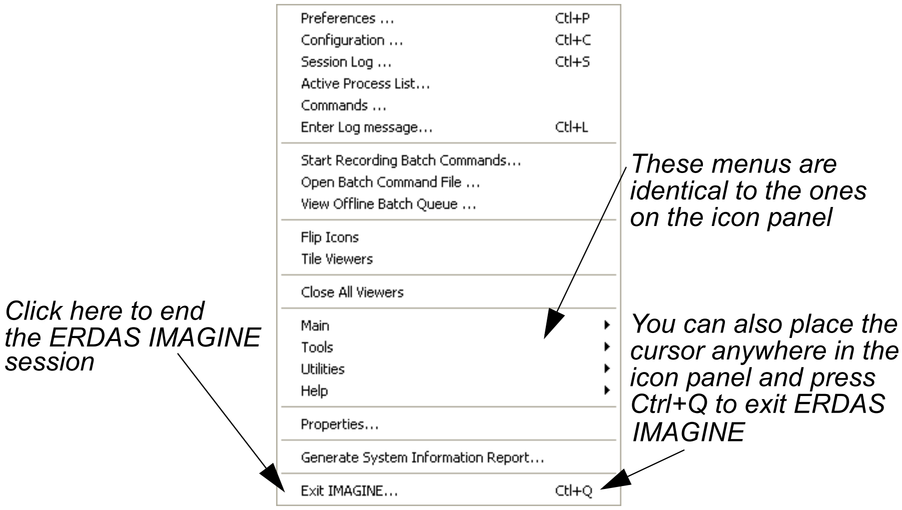
ERDAS IMAGINE Menu Bar

The menus on the ERDAS IMAGINE menu bar are: **Session**, **Main**, **Tools**, **Utilities**, and **Help**. These menus are described in this section.

NOTE: Any items which are unavailable in these menus are shaded and inactive.

Session Menu

1. Click the word **Session** in the upper left corner of the ERDAS IMAGINE menu bar. The **Session** menu opens:



The following table contains the **Session** menu selections and their functionalities:

Table 1: Session Menu Options

Selection	Functionality
Preferences	Set individual or global default options for many ERDAS IMAGINE functions (Viewer, Map Composer, Spatial Modeler, etc.).
Configuration	Configure peripheral devices for ERDAS IMAGINE.
Session Log	View a real-time record of ERDAS IMAGINE messages and commands.
Active Process List	View and cancel currently active processes running in ERDAS IMAGINE.
Commands	Open the Session Command History dialog, in which you can enter EML commands to test during script development, or view EML command history.
Enter Log Message	Enter text to insert into the Session Log.
Start Recording Batch Commands	Open the Batch Wizard. Collect commands as they are generated by clicking the **Batch** button that is available on many ERDAS IMAGINE dialogs.
Open Batch Command File	Open a Batch Command File (*.bcf) you have saved previously.

Table 1: Session Menu Options (Continued)

Selection	Functionality
View Offline Batch Queue	Open the Scheduled Batch Job List dialog, which lets you view, edit, or delete pending batch jobs.
Flip Icons	Select horizontal or vertical icon panel display.
Tile Viewers	Rearrange two or more Viewers on the screen so that they do not overlap.
Close All Viewers	Close all Viewers that are currently open.
Main	Access a menu of tools that corresponds to the icons along the ERDAS IMAGINE icon bar.
Tools	Access a menu of tools that allow you to view and edit various text and image files.
Utilities	Access a menu of utility items that allow you to perform general tasks in ERDAS IMAGINE.
Help	Access the ERDAS IMAGINE On-Line Help.
Properties	Open the IMAGINE Properties dialog where system information, environment variables and licensing information is available.
Generate System Information Report	Generate a report of essential IMAGINE operating system parameters for printing.
Exit IMAGINE	Exit the ERDAS IMAGINE session (keyboard shortcut: Ctrl+Q).

Main Menu

2. Click the word **Main** in the ERDAS IMAGINE menu bar. The **Main** menu opens

The following table contains the **Main** menu selections and their functionalities:

.

Table 2: Main Menu Options

Selection	Functionality
Start IMAGINE Viewer	Start an empty Viewer.
Import/Export	Open the Import/Export dialog.
Data Preparation	Open the **Data Preparation** menu.
Map Composer	Open the **Map Composer** menu.
Image Interpreter	Open the **Image Interpreter** menu.
Image Catalog	Open the Image Catalog dialog.
Image Classification	Open the **Classification** menu.
Spatial Modeler	Open the **Spatial Modeler** menu.
Vector	Open the **Vector Utilities** menu.
Radar	Open the **Radar** menu.
VirtualGIS	Open the **VirtualGIS** menu.
Subpixel Classifier	Open the **Subpixel Classifier** menu.
DeltaCue	Open the **DeltaCue** menu.
Stereo Analyst	Open the **Stereo Analyst** menu.
IMAGINE AutoSync	Open the **AutoSync** menu.
IMAGINE Objective	Open the **Objective** Workstation.

Tools Menu

3. Click the word **Tools** in the ERDAS IMAGINE menu bar. The **Tools** menu opens:

The following table contains the **Tools** menu selections and their functionalities:

Table 3: Tools Menu Options

Selection	Functionality
Edit Text Files	Open the IMAGINE Text Editor to create and edit ASCII text files.
Edit Raster Attributes	Open the Raster Attribute Editor to view and edit raster attribute data.
View Binary Data	Open the DataView dialog to view the contents of binary files in a number of different ways.
View IMAGINE HFA File Structure	Open the HfaView dialog to view ERDAS IMAGINE files stored in hierarchical file architecture format.
Annotation Information	Open the Annotation Info dialog to view information for annotation files, including number of elements and projection information.
Image Information	Open the ImageInfo dialog to view full image information for a selected ERDAS IMAGINE raster image.
Vector Information	Open the VectorInfo dialog to view full image information for a selected ERDAS IMAGINE vector coverage.
Image Command Tool	Open the Image Commands dialog to use image manipulation tools.
NITF Metadata Viewer	Open the NITF Metadata Viewer dialog to view the metadata for an NITF file.

Table 3: Tools Menu Options (Continued)

Selection	Functionality
Coordinate Calculator	Open the Coordinate Calculator to transform coordinates from one spheroid or datum to another.
Create/Display Movie Sequences	Open the Movie viewer to create and view a series of images in rapid succession.
Create/Display Viewer Sequences	Open the VUE Player to view a series of images saved from the Viewer.
Image Drape	Open the Image Drape Viewer to create a perspective view by draping imagery over a terrain DEM.
DPPDB Workstation	Start the Digital Point Positioning DataBase Workstation (if installed).
View EML ScriptFiles	Open the EML View dialog, which enables you to view, edit, and print ERDAS IMAGINE dialogs. (UNIX Developer's Toolkit installation only.)

Utilities Menu

4. Click **Utilities** on the ERDAS IMAGINE menu bar. The **Utilities** menu opens:

The following table contains the **Utilities** menu selections and their functionalities:

Table 4: Utility Menu Options

Selection	Functionality
JPEG Compress Images	Compress raster images using the JPEG compression technique and save them in an ERDAS IMAGINE format.
Decompress JPEG Images	Decompress images compressed using the JPEG Compress Images utility.
Convert Pixels to ASCII	Open the Pixel to Table dialog to output raster data file values to an ASCII file.
Convert ASCII to Pixels	Open the Table to Pixel dialog to create an image from an ASCII file.
Convert Images to Annotation	Convert a raster image to polygons saved as ERDAS IMAGINE annotation file (.ovr).
Convert Annotation to Raster	Convert an annotation file containing vector graphics to a raster image file.
Create/Update Image Chips	Open the Image Chip Maker to generate image chips for one or more images.
Create Font Tables	Open the Font Table Maker to create a map of characters in a particular font.
Font to Symbol	Open the Font to Symbol Maker to create a symbol library to use as annotation characters from an existing font.
Compare Images	Open Image Compare dialog to compare layers, raster, map info between two images.
Oracle Spatial Table Tool	Open Oracle GeoRaster Table Manager to edit records and columns in an Oracle spatial database.
CSM Plug-in Manager	Open CSM Plug-in Manager dialog to configure Community Sensor Model plug-in DLLs.
Reconfigure Raster Formats	Update the list of available raster DLLs after adding new raster DLLs.
Reconfigure Vector Formats	Update the list of available vector DLLs after adding new vector DLLs.

Table 4: Utility Menu Options (Continued)

Selection	Functionality
Reconfigure Resample Methods	Update the list of available resampling DLLs after adding new resampling DLLs.
Reconfigure Geometric Models	Update the list of available geometric models after adding new geometric models.
Reconfigure PE GCS Codes	Calculate Geographic Coordinate System codes in the projection engine, a set of libraries that handles projections for shapefiles.

Help Menu

5. Select **Help** from the ERDAS IMAGINE menu bar. The **Help** menu opens.

NOTE: The **Help** *menu is also available from the* **Session** *menu.*

The following table contains the **Help** menu selections and their functionalities:

Table 5: Help Menu Options

Selection	Functionality
Help for Icon Panel	View the On-Line Help for the ERDAS IMAGINE icon panel.
IMAGINE Online Documentation	Open the entire On-Line Help file, containing a navigation pane, page view pane and contents, index and search tools.
IMAGINE Version	View the ERDAS IMAGINE software version that is installed.
IMAGINE DLL Information	Open the DLL Version Tool to see current DLL categories and DLL instances in each category.
About ERDAS IMAGINE	View ERDAS IMAGINE version number, date, and development credits.

Dialogs

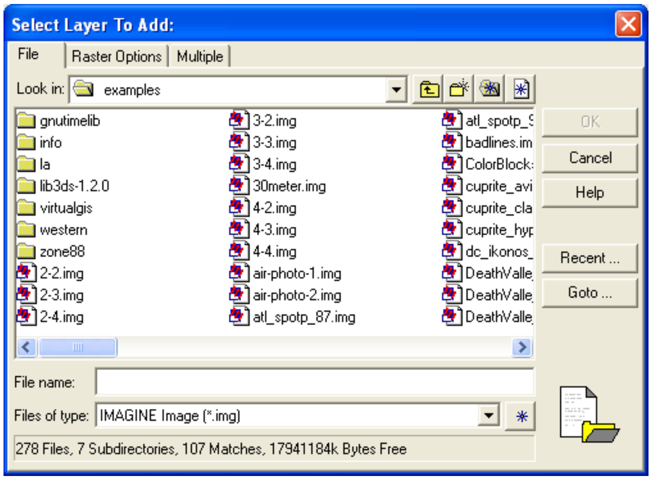
A dialog is a window in which you enter file names, set parameters, and execute processes. In most dialogs, there is very little typing required—simply use the mouse to click the options you want to use.

Most of the dialogs used throughout the tour guides are reproduced from the software, with arrows showing you where to click. These instructions are for reference only. Follow the numbered steps to actually select dialog options.

For On-Line Help with a particular dialog, click the **Help** button in that dialog.

All of the dialogs that accompany the raster and vector editing tools, as well as the Select Layer To Add dialog, contain a Preview chip pane, which enables you to view the changes you make to the Viewer image before you click **Apply**.

Many of the functions in ERDAS IMAGINE are accessible through dialogs similar to the one below:



More Information/Help

As you go through the tour guides, or as you work with ERDAS IMAGINE on your own, there are several ways to obtain more information regarding dialogs, tools, or menus, as described below.

On-Line Help

There are two main ways you can access On-Line Help in ERDAS IMAGINE:

- select the **Help** option from a menu bar
- click the **Help** button on any dialog

Status Bar Help

The status bar at the bottom of the Viewer displays a quick explanation for buttons when the mouse cursor is placed over the button. It is a good idea to keep an eye on this status bar, since helpful information displays here, even for other dialogs.

Bubble Help

The **User Interface & Session** category of the Preference Editor enables you to turn on Bubble Help, so that the single-line Help displays directly below your cursor when your cursor rests on a button or frame part. This is helpful if the status bar is obscured by other windows.

Fourier Transform Editor

Introduction

In this tour guide, you enhance and destripe a 512 × 512 subset of a Landsat Thematic Mapper image using both interactive and automatic methods available in the ERDAS IMAGINE Fourier Analysis tools.

Not all of the edits in this tour guide necessarily enhance the image. Many exercises are performed simply to show you how they affect the image. When you use these techniques on other data sets, you may want to experiment with different methods, or combinations of methods, to find the techniques that work best.

We highly recommend that you read the Fourier Analysis section, in the "Enhancement" chapter in the ERDAS Field Guide, Volume 2, before going through this tour guide.

If you are new to ERDAS IMAGINE, we recommend that you complete "Viewer & Geospatial Light Table" tour guide in the ERDAS IMAGINE Essentials Tour Guide before using the Fourier Transform Editor.

Approximate completion time for this tour guide is 45 minutes.

Create an .fft Layer

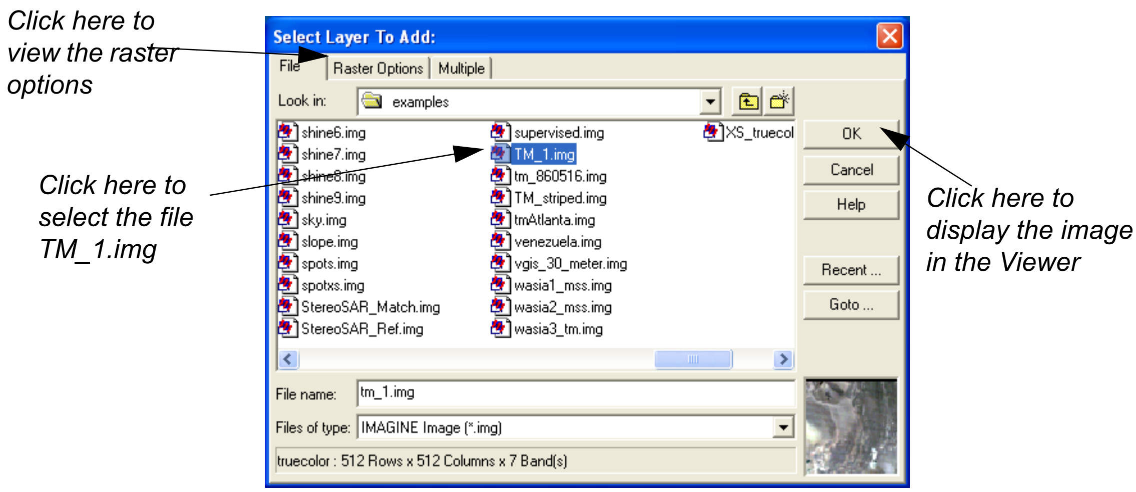
In order to use the Fourier Transform Editor, you must first create a Fourier Transform (.fft) layer from the input image.

Display Source File

ERDAS IMAGINE must be running and you must have a Viewer open.

1. Select **File -> Open -> Raster Layer** from the Viewer menu bar.

   The Select Layer To Add dialog opens.

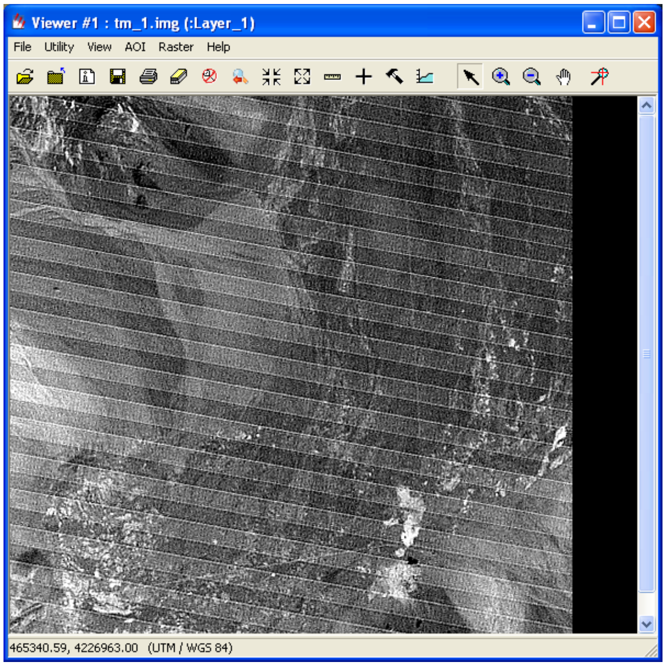


2. In the Select Layer To Add dialog under **File**, click **TM_1.img**.

3. Click the **Raster Options** tab at the top of the dialog and then select **Gray Scale** from the **Display as** dropdown list.

4. The **Display Layer** section updates so that you can select which layer of the file to display. Select **Layer 1**.

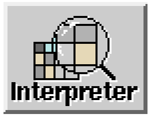
5. Click **OK** to display the image file in the Viewer.



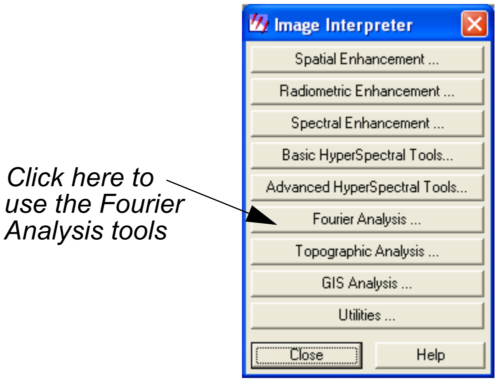
NOTE: You do not have to display a file before computing the .fft layer. This step is included to show you the image before any Fourier editing is performed.

Create FFT Output File

1. Click the Image Interpreter icon on the ERDAS IMAGINE icon panel.

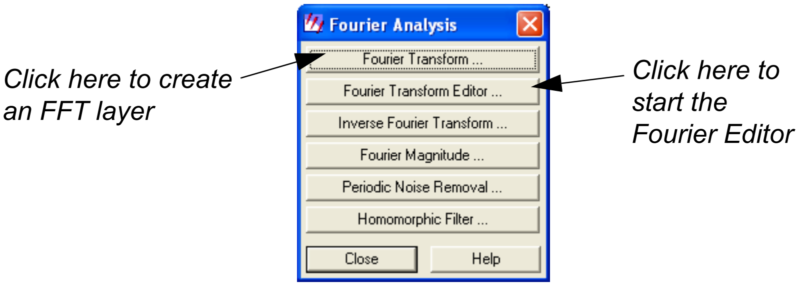


The **Image Interpreter** menu opens.



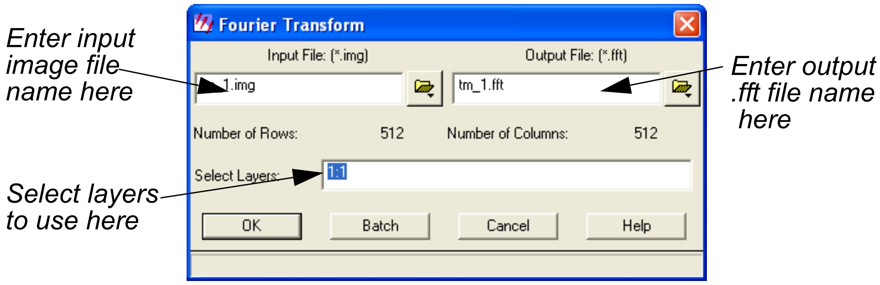
2. Select **Fourier Analysis** from the **Image Interpreter** menu.

The **Fourier Analysis** menu opens.



3. Select **Fourier Transform** from the **Fourier Analysis** menu.

The Fourier Transform dialog opens.



4. In the Fourier Transform dialog under **Input File**, type **TM_1.img**.

   Layer 1 of this file is badly striped. In this example, you work with only one layer to make the processing go faster. However, the techniques you use are applicable to multiple layers.

5. The name for the **Output File**, **TM_1.fft**, is automatically generated. Make sure it is in a directory in which you have write permission. The default is your default data directory set by **Session -> Preferences**.

6. Enter **1:1** in the **Select Layers** field.

7. Click **OK** in the Fourier Transform dialog to create the new file.

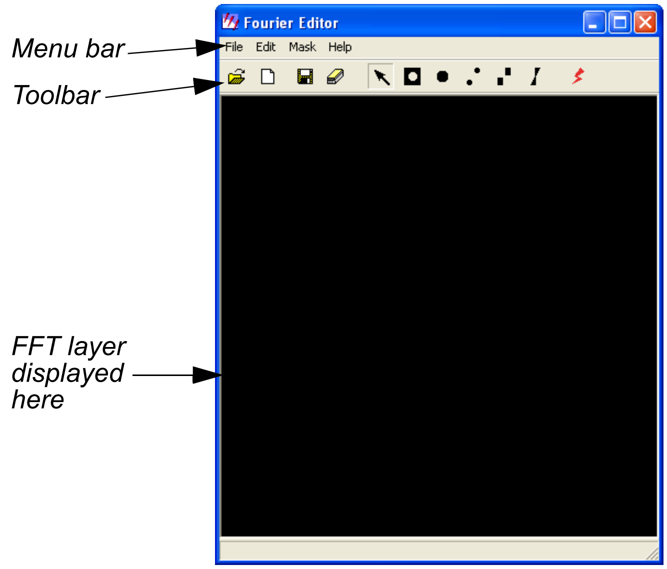
   A Job Status dialog displays, showing the progress of the function. When the process is 100 percent complete, click **OK**.

Start the Fourier Transform Editor

With the .fft file created, you are ready to begin using the Fourier Transform Editor.

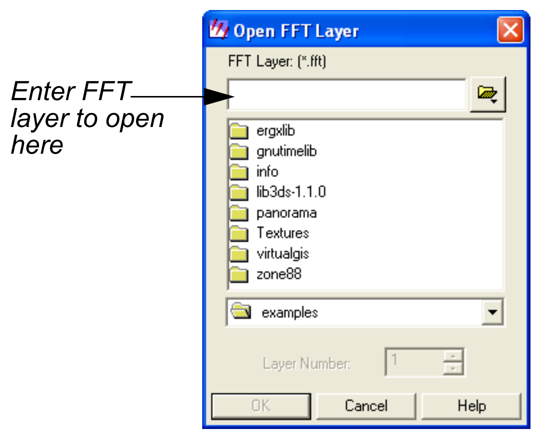
1. In the **Fourier Analysis** menu, select **Fourier Transform Editor**.

   The Fourier Editor opens.



2. In the Fourier Editor, click the Open icon on the toolbar, or select **File -> Open** from the menu bar.

   The Open FFT Layer dialog opens.

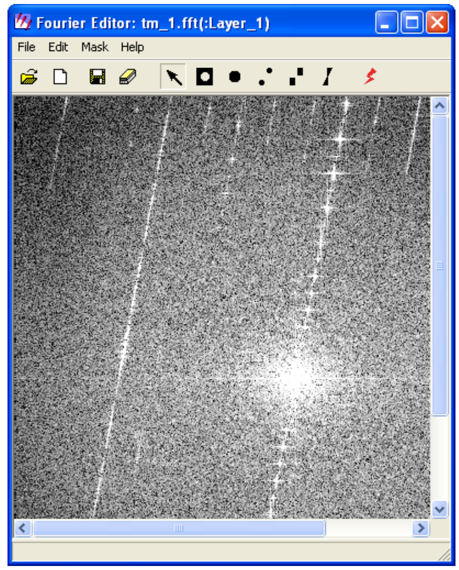


3. In the Open FFT Layer dialog under **FFT Layer**, enter the path and name of the .fft layer you created in **step 4.** through **step 5.** (for example, **TM_1.fft**).

   Since this file contains only one layer, the **Layer Number** defaults to **1**. However, if the file contained more than one layer, you could choose the layer to edit here. Edits performed on one layer can be applied to all layers of the .fft file using the **File -> Save All** option on the Fourier Editor menu bar.

4. Click **OK** to display the selected file in the Fourier Editor.

A status meter opens as the layer is read. Then the layer displays.

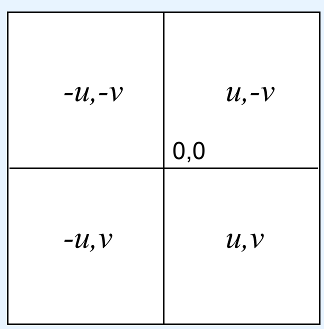


You can resize the Fourier Editor window to see the entire file.

5. Click any point inside the Fourier Editor and the coordinates of that point are shown in the status bar. Hold and drag to dynamically update the coordinates.

Fourier Editor Coordinates

The coordinates are referred to as (u,v) with the origin (u,v = 0,0) at the center of the image. See the illustration below.



Since Fourier images are symmetrical, a point in one quadrant is exactly the same as the corresponding point in the opposite quadrant. For example, point (64,170) is the same as point

Edit Using Menu Options

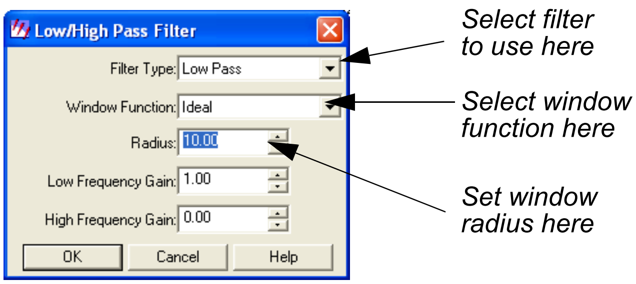
As previously stated, the menu bar and mouse-driven tools offer the same techniques and kinds of edits, only the method is different. In the menu bar options, you enter all parameters into dialogs. In many cases you want to use the mouse to view the coordinates of the .fft layer, so that you know what information to enter into the dialogs. In the next series of steps, you use some of the menu bar editing options. Then, in the next section, you perform many of those same edits using the mouse-driven tools.

Use Low-Pass Filtering

Low-pass filtering allows you to attenuate the high-frequency components of the image, but allows the low-frequency components to pass through.

1. Select **Mask -> Filters** from the Fourier Editor menu bar.

   The Low/High Pass Filter dialog opens.



> ***Filter Types***
>
> When the **Filter Type** is set to **Low Pass**, its function is the same as the Low Pass Filter icon on the toolbar.
>
> When the **Filter Type** is set to **High Pass**, its function is the same as the High Pass Filter icon on the toolbar.

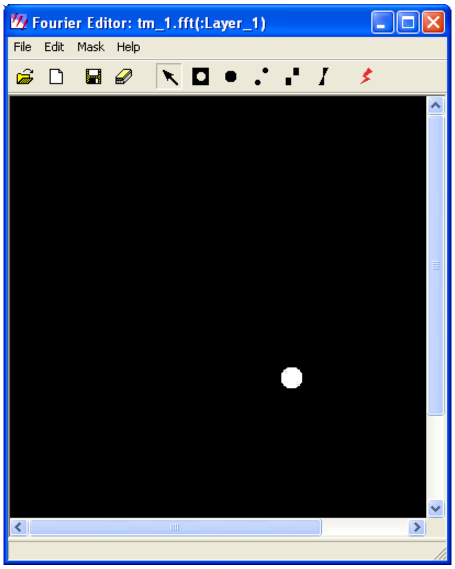
2. In the Low/High Pass Filter dialog, click the **Window Function** dropdown list and select **Ideal**.

   An ideal window function produces a sharp transition at the edge of the filter.

3. Change the **Radius** to **10.00**.

4. Leave all other parameters as they are and click **OK**.

A low-pass filter is applied to all values outside of the radius of 10.00. Therefore, the image is black, except for a small white circle in the center.



Removing this much of the layer removes much of the content of the image, so you may want to undo this edit and try again.

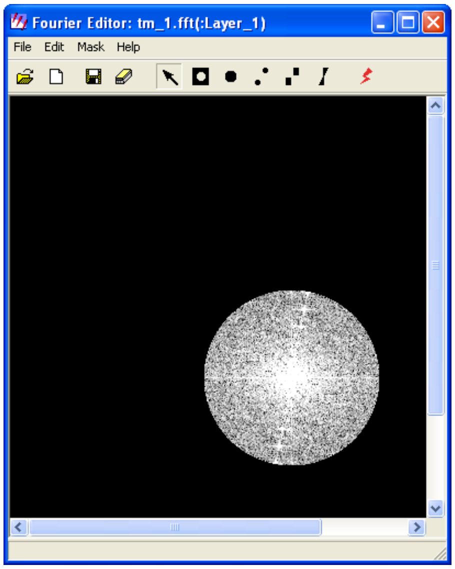
5. Select **Edit -> Undo** from the Fourier Editor menu bar.

   The image is restored to its original state.

Select a Different Filter

1. Select **Mask -> Filters**.
2. In the Low/High Pass Filter dialog, click the **Window Function** dropdown list and select **Ideal**.
3. Enter a **Radius** of **80.00**.
4. Click **OK** in the Low/High Pass Filter dialog.

   All frequencies outside the radius of 80 are attenuated and frequencies inside the radius are unaffected. The .fft layer looks similar to the following example:

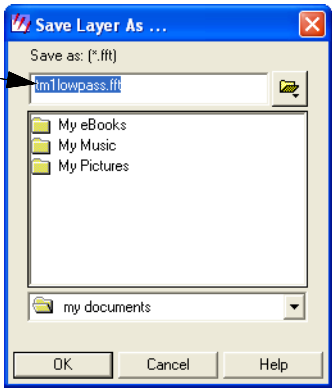


Save the File

1. Select **File -> Save As** from the Fourier Editor menu bar.

   The Save Layer As dialog opens.

Enter a new name for the FFT layer here



2. In the directory of your choice, enter a name for the new .fft layer, such as **TM1lowpass.fft**.

3. Click **OK** to save the file.

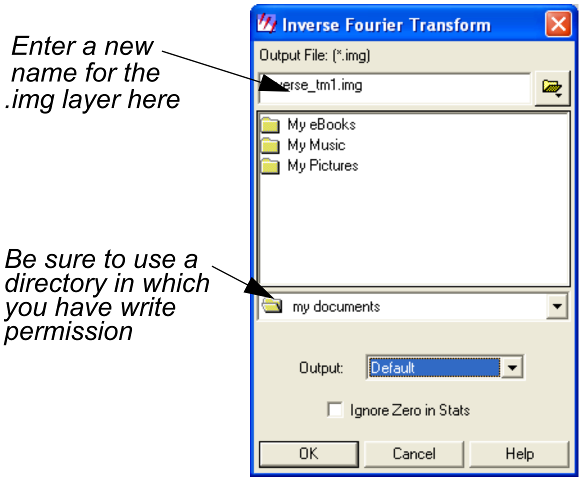
Apply an Inverse Fourier Transformation

Now, perform an inverse Fourier transformation so that you can view the original image and see what effect this edit had on it.

You must save your edits before performing an Inverse Transform Operation.

1. In the Fourier Editor, click the Run icon on the toolbar or select **File -> Inverse Transform** from the menu bar.

   The Inverse Fourier Transform dialog opens.



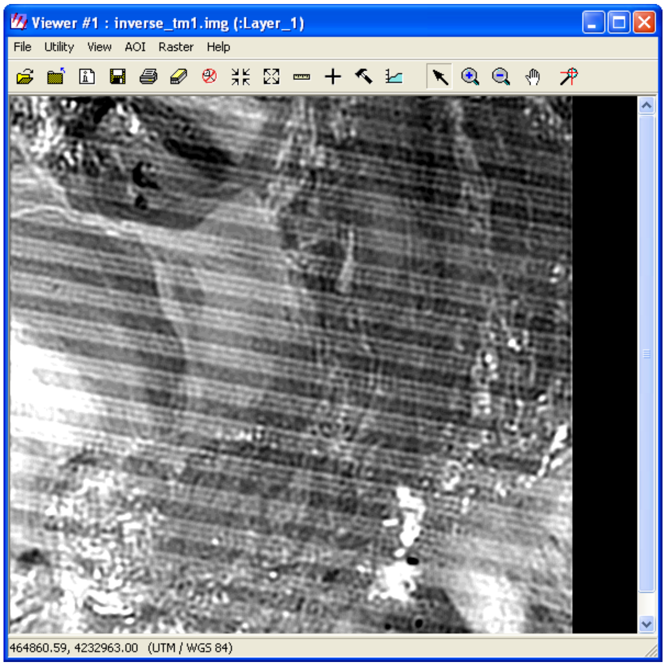
2. In the Inverse Fourier Transform dialog under **Output File**, enter a name for the new output file, such as **inverse_TM1.img**. This file has an .img extension by default. Be sure to use a directory in which you have write permission.

3. Click **OK** to create the new file.

   A Job Status dialog displays, indicating the progress of the function.

4. When the Job Status dialog indicates that the file is created, click **OK** and then display the file in a Viewer.

   Your file should look similar to the following example:



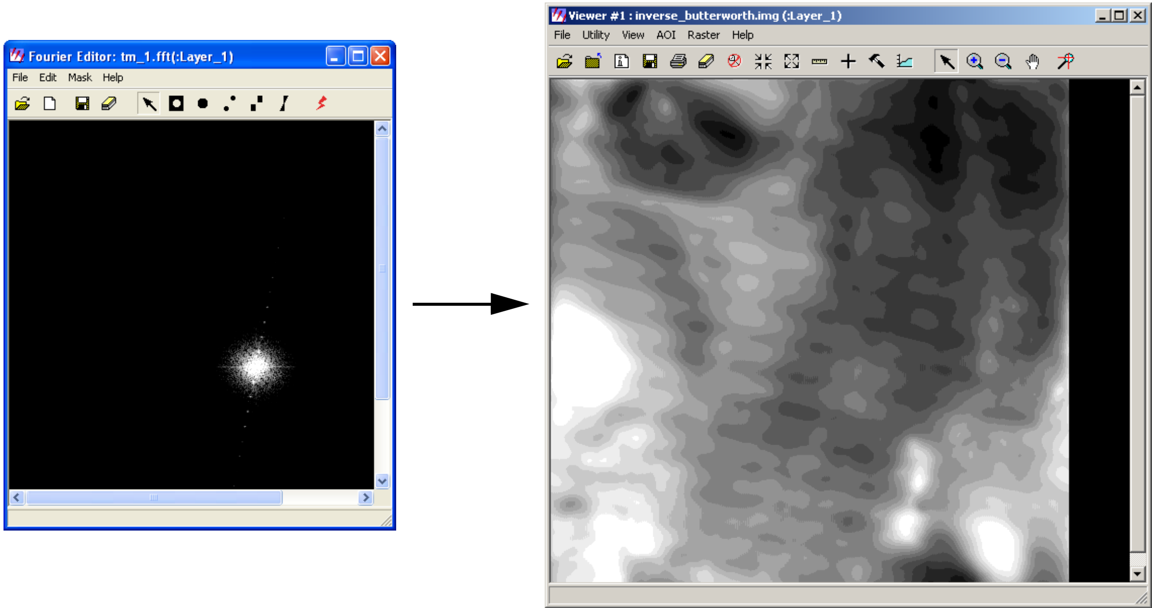
For the other edits performed in this Tour Guide, you can save the .fft layer and perform an inverse Fourier transform at any time. The steps for doing so are not repeated here. However, the result is shown so that you can see how each edit affects the image.

Apply Other Filters

1. In the Fourier Editor, click the Open icon  on the toolbar, or select **File -> Open** from the menu bar.
2. In the Open FFT Layer dialog under **FFT Layer**, enter the name of the first .fft layer you displayed (for example, **TM_1.fft**).
3. Click **OK** to display the selected file in the Fourier Editor.
4. When the file displays, select **Mask -> Filters** from the Fourier Editor menu bar.
5. In the Low/High Pass Filter dialog, click the **Window Function** dropdown list and select **Butterworth**.

   This is a smoother function than the Ideal. Use a radius of 80.00, just as with the Ideal.
6. Change the **Radius** to **80.00**.
7. Click **OK** in the Low/High Pass Filter dialog.

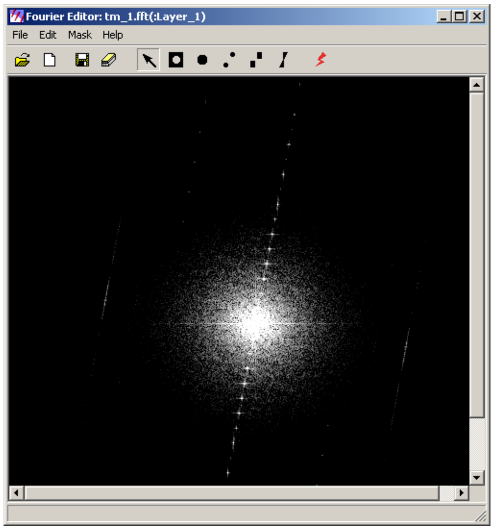
The .fft layer and the resulting image are shown in the following picture:

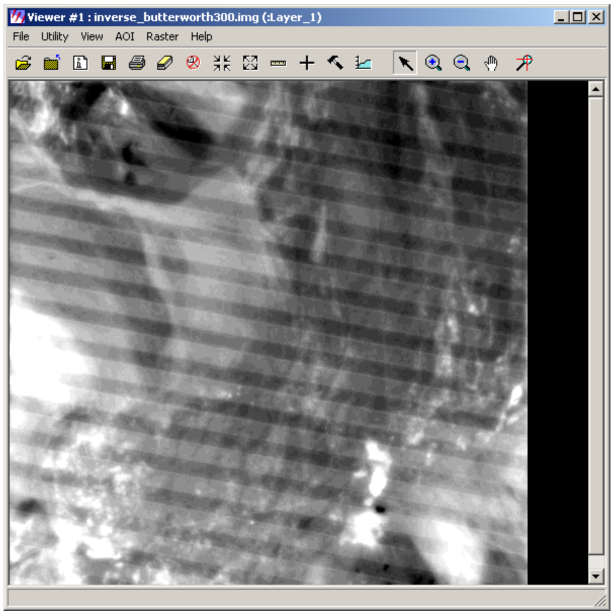


This filter eliminated much of the image content because the radius was too small.

8. Try this same exercise using a **Radius** of **300.00**, rather than **80.00**

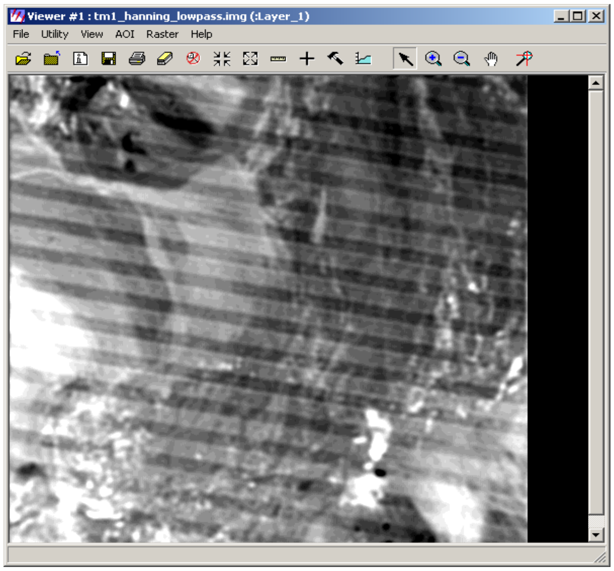
   The resulting image looks like the following example:



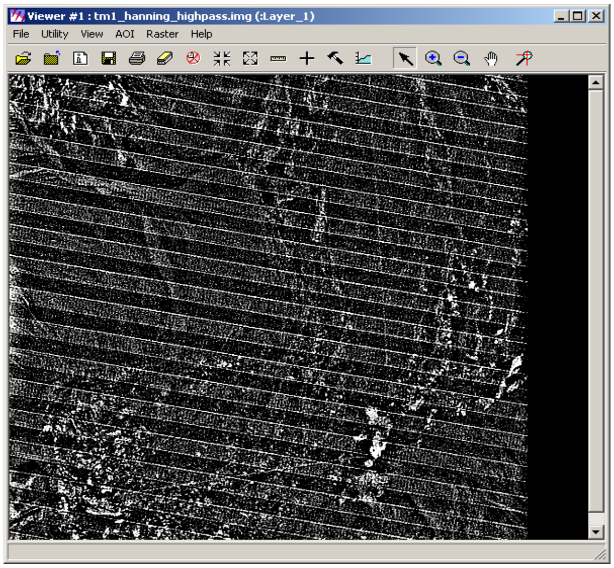


The image is visibly smoothed (perhaps too much). However, the striping remains. You remove the stripes using the wedge filter later in this tour guide. You could try using the Butterworth filter with an even larger radius or the other windows.

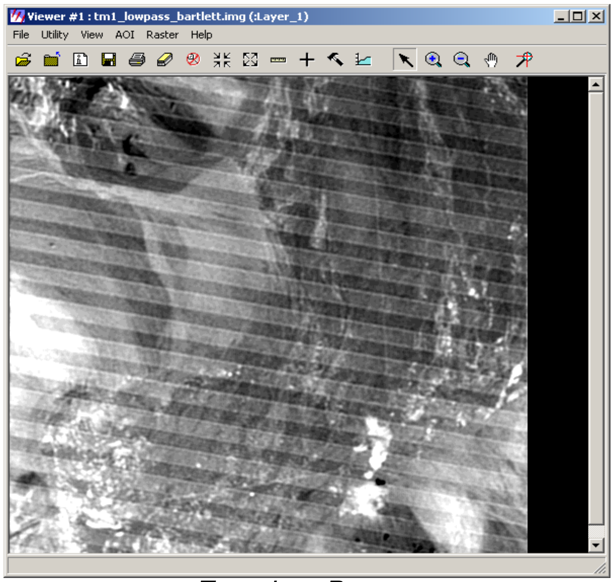
The following graphics illustrate some of these other scenarios.



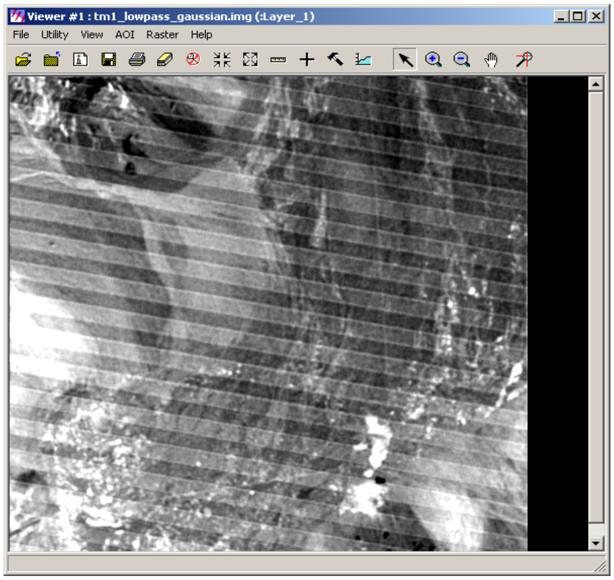
Type: Low Pass
Window: Hanning
Radius: 100.00



Type: High Pass
Window: Hanning
Radius: 20.00



Type: Low Pass
Window: Bartlett
Radius: 150.00



Type: Low Pass
Window: Gaussian
Radius: 200.00

9. Redisplay the original .fft layer in the Fourier Editor.

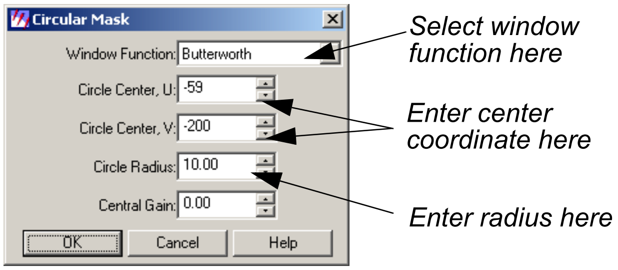
Use a Circular Mask

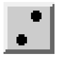
There are several bright spots in the .fft layer, such as those in the upper left quadrant. These can be eliminated using the circular mask option.

1. With your cursor in the Fourier Editor, click in the center of one of these bright areas. There is one at (*u*,*v*) = (-59,-200). You use this coordinate here, but you can use another if you like.

2. When you have selected a coordinate, select **Mask -> Circular Mask** from the Fourier Editor menu bar.

   The Circular Mask dialog opens.



   This option is the same as if you were to click the Circular Mask icon  on the toolbar.

3. In the Circular Mask dialog, click the **Window Function** dropdown list and select **Butterworth**.

4. Enter **-59** for the **Circle Center, U** and **-200** for the **Circle Center, V**.

5. Enter a **Circle Radius** of **20**.

6. Click **OK** in the Circular Mask dialog to edit the .fft layer.

   The bright spot disappears. This edit does not affect the appearance of this particular image very much, since it is such a small area and because the edited area is quite far from the center of the image where most of the image content is contained. However, this technique can be used to remove spikes caused by errant detectors and other types of periodic noise that are manifested by concentrated areas of high or low frequency in the .fft layer.

   As an experiment, you create two circles of low frequency to see how they affect the image.

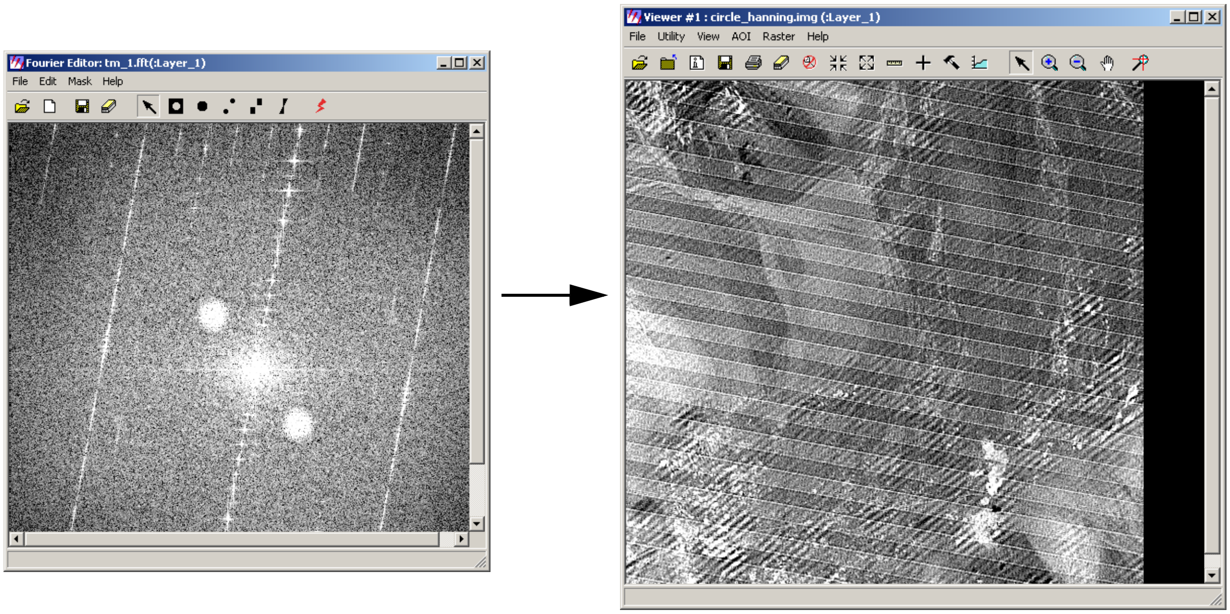
7. In the Fourier Editor, select **Mask -> Circular Mask**.

8. In the Circular Mask dialog, enter a **Circle Center, U** of **44** and a **Circle Center, V** of **57**.

9. Enter a **Circle Radius** of **20.00** and a **Central Gain** of **10.00**.

10. Click **OK** in the Circular Mask dialog.

The .fft layer and resulting image look like the following example:



The resulting image has a pronounced diagonal striping, in addition to the original striping.

NOTE: Remember to select another circle center coordinate before trying each new window.

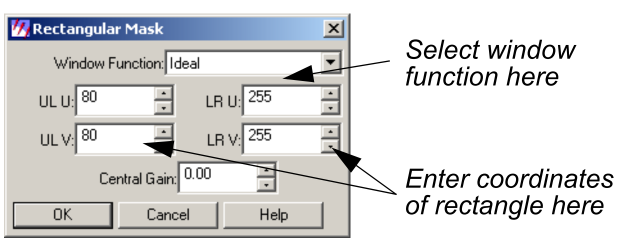
Use a Rectangular Mask

The rectangular mask allows you to mask a rectangular area of the .fft layer. This is similar to the circular mask in that it allows you to edit non-central regions of the Fourier image.

1. Make sure the .fft file you created in the previous section, **"Use a Circular Mask"**, displays in the Fourier Editor.

2. In the Fourier Editor menu bar, select **Mask -> Rectangular Mask**.

   The Rectangular Mask dialog opens.



3. In the Rectangular Mask dialog, click the **Window Function** dropdown list and select **Ideal**.

4. Enter an upper left *u* (**UL U**) of **80** and an upper left *v* (**UL V**) of **80**.

5. Enter a lower right *u* (**LR U**) of **255** and a lower right *v* (**LR V**) of **255**.

6. Click **OK** in the Rectangular Mask dialog.

   The top left and bottom right corners of the .fft layer are black. To mask the other two corners, you must repeat this procedure.

7. Select **Mask -> Rectangular Mask**.

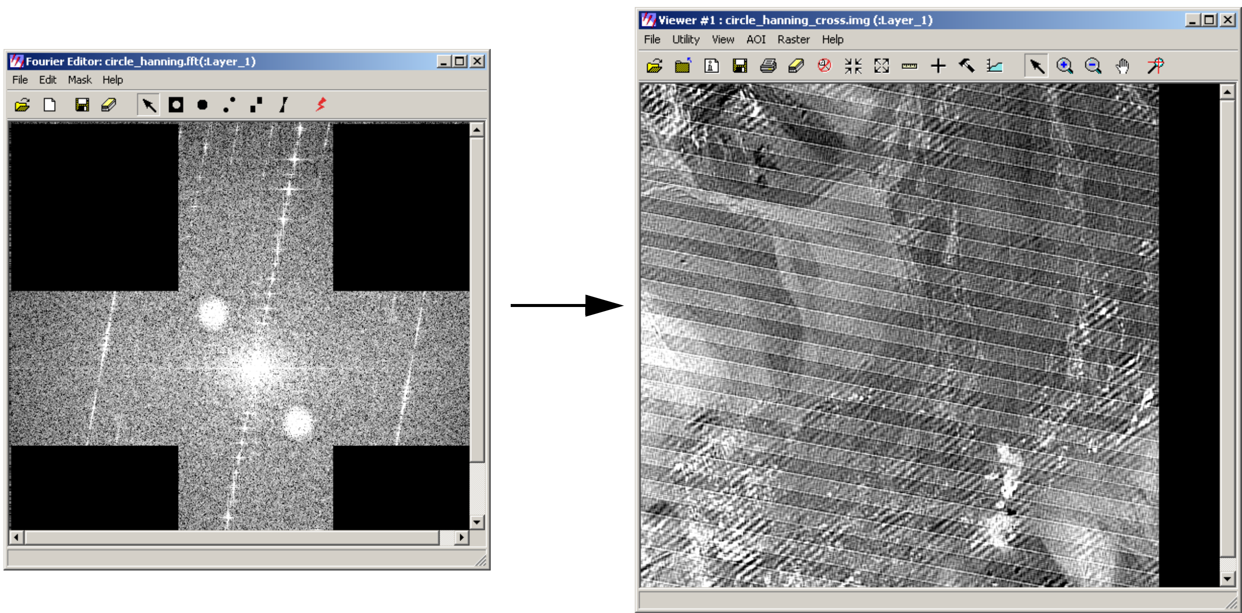
8. In the Rectangular Mask dialog, click the **Window Function** dropdown list and select **Ideal**.

9. Enter an upper left *u* (**UL U**) of **80** and an upper left *v* (**UL V**) of **-255**.

10. Enter a lower right *u* (**LR U**) of **255** and a lower right *v* (**LR V**) of **-80**.

11. Click **OK** in the Rectangular Mask dialog.

    The top, right and bottom, left corners of the .fft layer are now black also, making the .fft layer look like a cross.



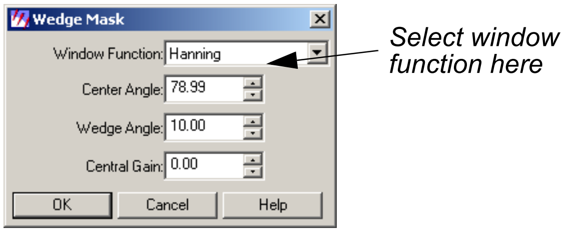
The resulting image is visibly smoother than the original.

Use a Wedge Mask

The wedge mask option is often used to remove striping in imagery that appears in the .fft layer as radial lines. Most of the striping in the Landsat image you are using is manifested in the .fft layer as the bright, nearly vertical line that passes through the origin.

1. If it is not already displayed, open the original .fft layer in the Fourier Editor (that is, **TM_1.fft**).
2. With your cursor in the Fourier Editor, click in the center of one of the bright areas that make up the line. You need to enter this information in the dialog. For this example, you use (35, -187).
3. Select **Mask -> Wedge Mask**.

   The Wedge Mask dialog opens.



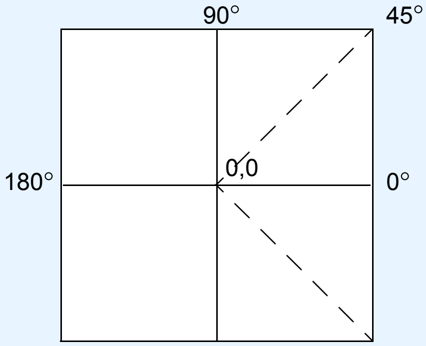
4. In the Wedge Mask dialog for the **Center Angle**, enter the following expression to calculate the center of the wedge, based on the coordinate that you selected.

```
-atan(-185/36)
```

5. Press Enter on your keyboard. The value returned is **78.99**.

Wedge Mask Angles

The angles are measured as shown in the illustration below.

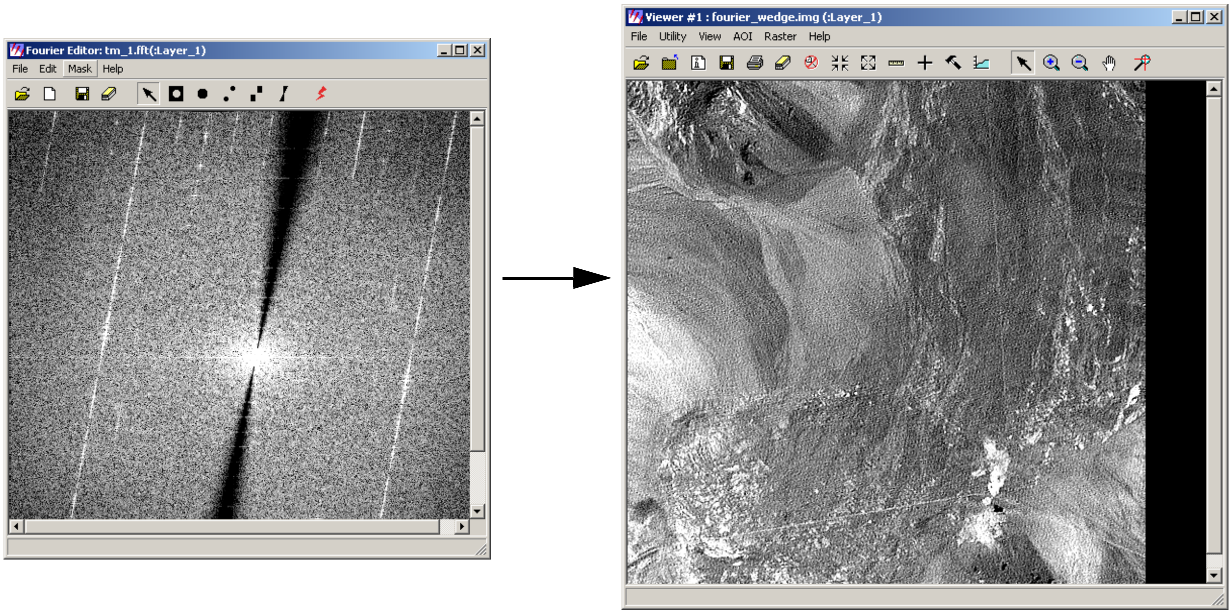


6. Enter a **Wedge Angle** of **10.00**.

   This is the total angle of the wedge, in this case, 5.00 degrees on either side of the center.

7. Click **OK** to edit the layer.

The resulting .fft layer looks similar to the following example:



After performing an inverse Fourier transform, the resulting image is destriped.

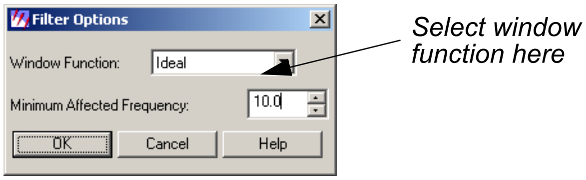
Edit Using Mouse-Driven Tools

The mouse-driven tools allow you to perform the same types of edits as in the menu options, but they are a bit easier to use since they are more interactive than the dialogs. You can extend a filter radius or indicate where to place a mask simply by dragging the mouse.

1. If it is not already displayed, open the original .fft layer in the Fourier Editor (for example, **TM_1.fft**).

2. From the Fourier Editor menu bar, select **Edit -> Filter Options**.

   The Filter Options dialog opens.



This is where you set the window that is used for all subsequent mouse-driven editing options. However, you can change this window at any time. The **Minimum Affected Frequency** option allows you to enter the minimum frequency value that is affected by the filter. Setting this value to a number less than 10.00 might eliminate very low frequency data that are crucial to the content of the image.

3. In the Filter Options dialog, click the **Window Function** dropdown list and select **Ideal**.
4. Click **OK**.

Use Low-Pass Filtering

The first tool you use is the Low-Pass Filter tool.

1. Click the Low-Pass Filter icon on the Fourier Editor toolbar.
2. With your cursor in the center of the Fourier Editor, drag toward the right until the *u* coordinate in the status bar reads **80**. Then release the mouse.

   The image is filtered as soon as the mouse is released. This is equivalent to the second filtering operation you performed using the menu bar tools.

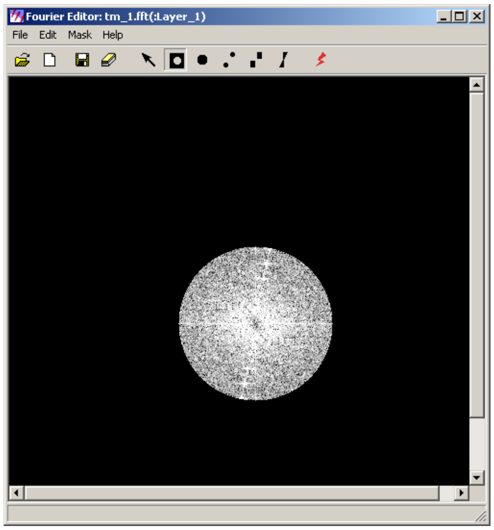
   You can select **Edit -> Undo** at any time to undo an edit. Select **File -> Revert** to undo a series of edits. The Low-Pass Filter tool remains active until you either select another tool or click the Select tool.

Use High-Pass Filtering

Next, you use the High-Pass Filter tool.

1. Select **Edit -> Filter Options** from the Fourier Editor menu bar.
2. In the Filter Options dialog, click the **Window Function** dropdown list and select **Hanning**.
3. Click **OK** in the Filter Options dialog.
4. Click the High-Pass Filter icon on the toolbar.
5. With your cursor in the center of the Fourier Editor, drag toward the right until the *u* coordinate in the status bar reads **20**. Release the mouse button.

   The image is filtered as soon as the mouse is released. The combination of filters (both Low-Pass and High-Pass) is shown in the following example:



6. Select **File -> Save As** from the menu bar.

   The Save Layer As dialog opens.

7. In the Save Layer As dialog, enter a new name for the .fft layer, such as **TMhighpass.fft**. Be sure to use a directory in which you have write permission.

8. Click **OK** to save the layer.

9. Click the Run icon  on the toolbar, or select **File -> Inverse Transform** from the menu bar to create an inverse Fourier layer for display.

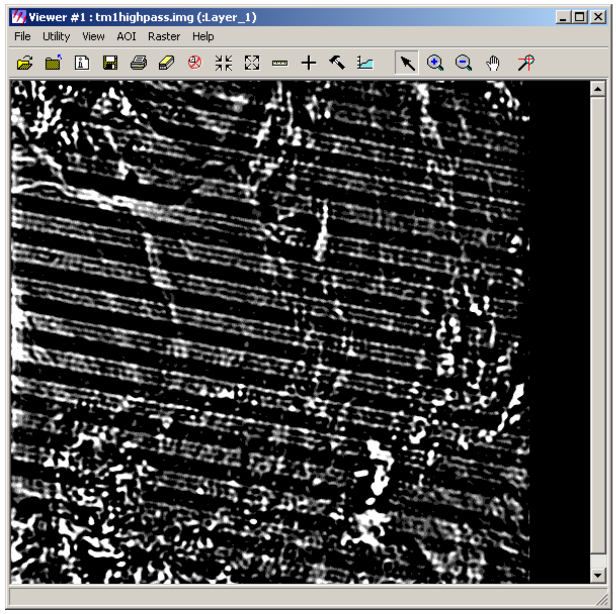
10. In the Inverse Fourier Transform dialog, enter a name for the new .img layer in the directory of your choice, such as **TM1highpass.img**.

11. Click **OK**.

    A Job Status dialog displays, indicating the progress of the function.

12. When the Job Status dialog indicates that the new .img layer is created, click **OK** and then display the layer in a Viewer.

    Your new image should look similar to the following example:



Apply a Wedge Mask

In the next exercise, you remove the nearly vertical radial line in the image, thereby removing the striping in the original image.

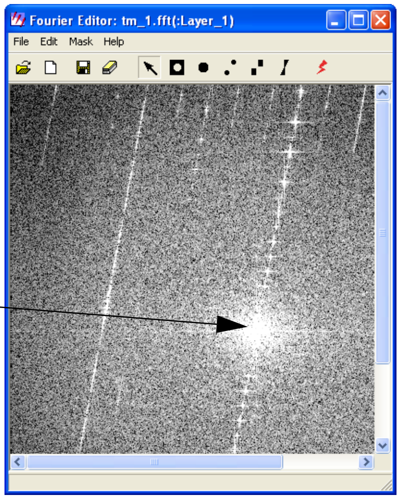
1. Redisplay the original .fft layer in the Fourier Editor if you have not already done so.

2. The Hanning window is still selected from the previous section, so you do not change it.

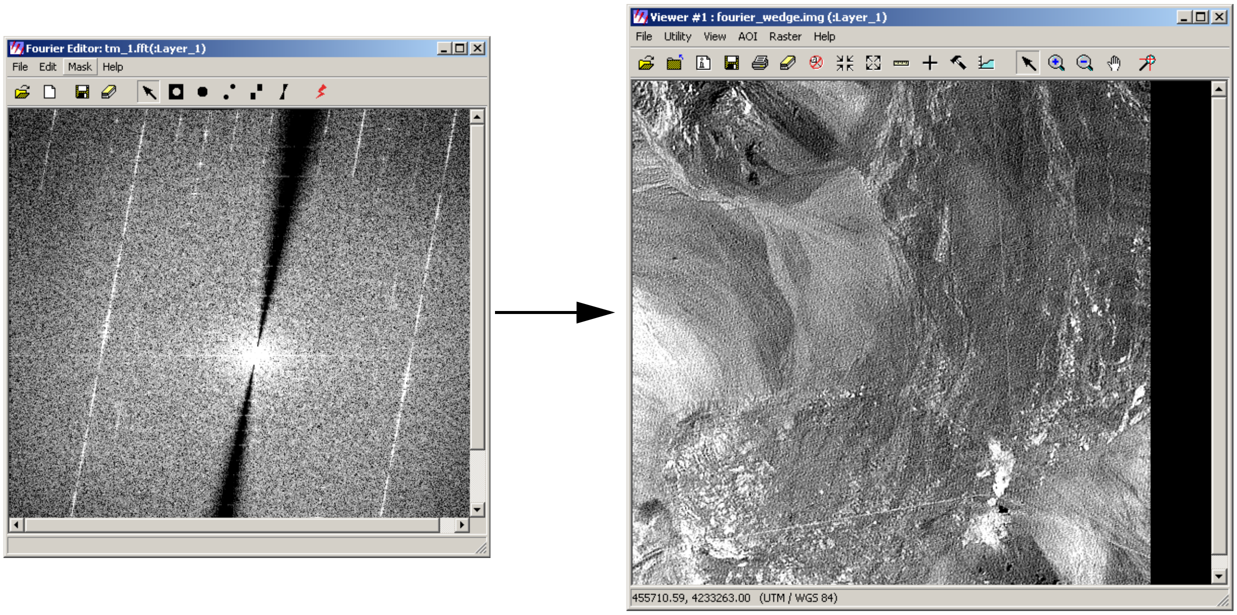
3. Click the Wedge Mask icon  on the toolbar.

4. Using the following example as a guide, with your cursor over the center of the line, drag to the right until the lines of the wedge are about 20 degrees apart. Release the mouse button.

Position your cursor in this area

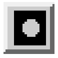


The image is filtered as soon as you release the mouse, and similar to the following example. The resulting image is also shown.



Combine Edits

You may combine as many edits as you like during an editing session. Since the Fourier Transform and Inverse Fourier Transform are linear operations, the effect of each edit on the resulting image is independent of the others. Here, you perform a low-pass filter over the wedged .fft layer that you just created.

1. With the .fft layer that you just created displayed in the Fourier Editor, click the Low-Pass Filter tool  .

2. With your cursor in the center of the Fourier Editor, drag toward the right until the *u* coordinate in the status bar is about **200**.

The .fft layer and resulting image look similar to the following:

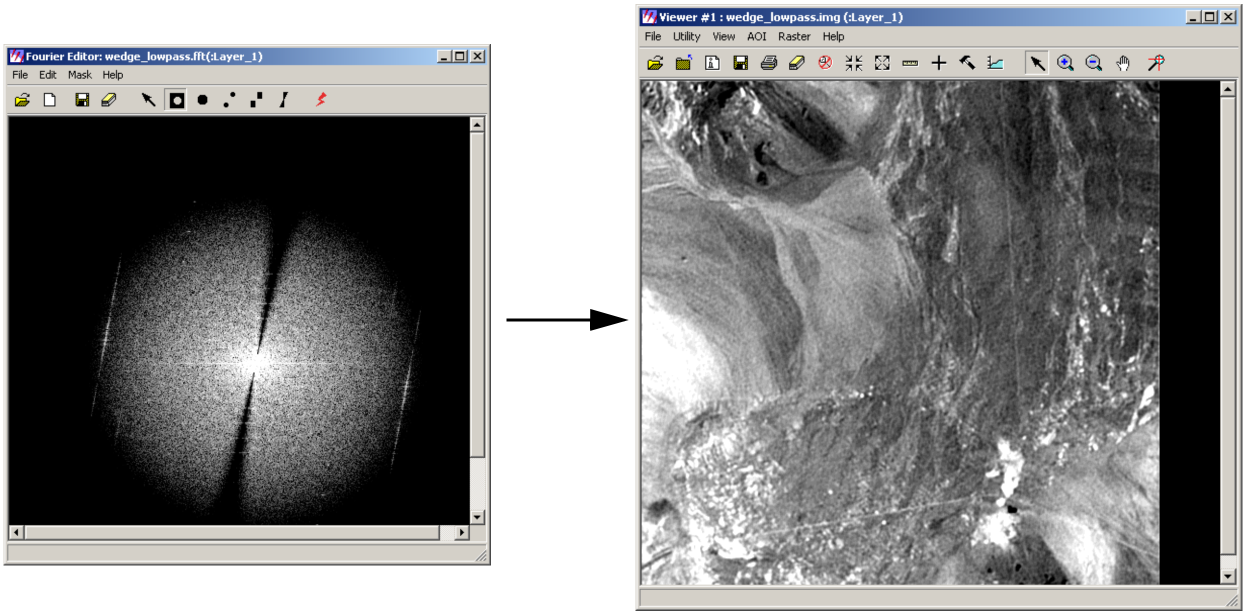

Fourier Editor: wedge_lowpass.fft(:Layer_1)
File Edit Mask Help
Viewer #1 : wedge_lowpass.img (:Layer_1)
File Utility View AOI Raster Help

Image Interpreter

Introduction

Image Interpreter is a group of over 50 functions that can be applied at the touch of a button to images with parameters you input. Most of the Image Interpreter functions are algorithms constructed as graphical models with Model Maker. These algorithms are common enhancements and utilities that have been made easily accessible through the Image Interpreter.

NOTE: Some of these functions are found in other parts of ERDAS IMAGINE, but are also listed in Image Interpreter for convenience.

The models used in Image Interpreter functions can be edited and adapted as needed with Model Maker (from Spatial Modeler) or the Spatial Modeler Language.

See the Spatial Modeler section of this manual for a description of the relationship between Spatial Modeler Language, Model Maker, and Image Interpreter. See the "Geographic Information Systems" chapter in the **ERDAS Field Guide Volume I** *for more information on modeling.*

Approximate completion time for this tour guide is 50 minutes.

Subsetting an Image

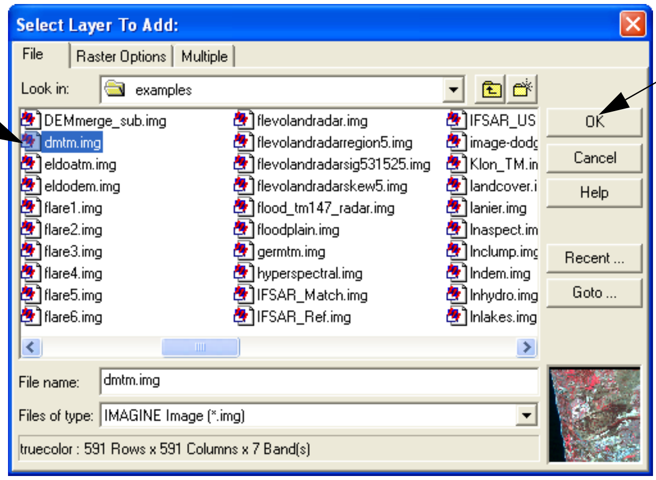
Many images used in IMAGINE cover a large area, while the actual area being studied can only cover a small portion of the image. To save on disk space and processing time, IMAGINE lets you make new images out of a subset of the entire data set.

In this exercise, you use the Subset Utility to take a subset of a small urbanized Area of Interest (AOI) from a much larger Landsat scene of San Diego.

ERDAS IMAGINE should be running with a Viewer open.

1. Select **File -> Open Raster Layer** from the Viewer menu bar.

   The Select Layer to add dialog opens.



2. Select **dmtm.img** from the list of examples.

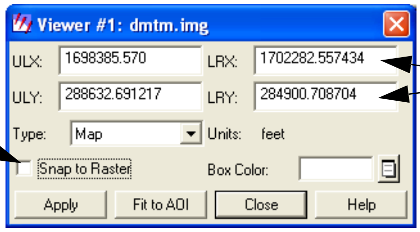
3. Click **OK** to have the image display in the Viewer.

Selecting an AOI to Subset

In this section, you use the Subset utility to take a small Subset from a large image without using the Snap to Raster option.

1. With the cursor in the Viewer, right-click to access the Quick View menu.

2. Select **Inquire Box...** from the Quick View menu. The Inquire Box dialog displays. The title of this dialog is **Viewer #1: dmtm.img**.



3. Click the **Snap to Raster** checkbox to uncheck this option. This tells the Subset function to use the exact coordinates you enter for the Inquire Box.

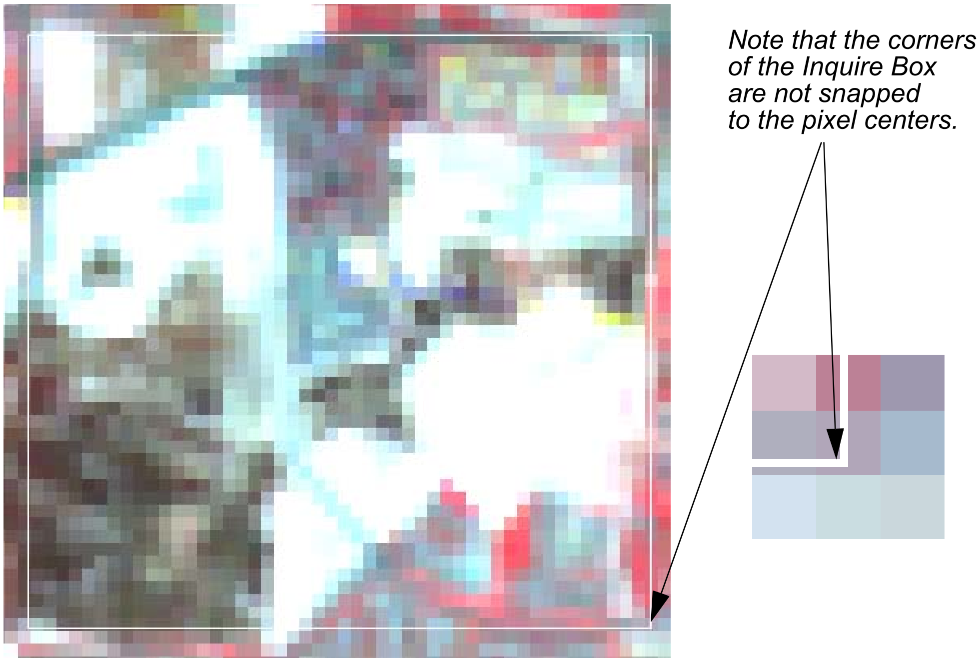
4. Enter the following coordinates into the Inquire Box dialog:

ULX: **1698385.570**
ULY: **288632.691217**
LRX: **1702282.557434**
LRY: **284900.708704**

5. Click **Apply** on the Inquire Box dialog. The Inquire Box moves to the new coordinates.

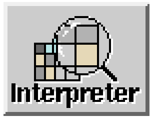
6. Click the Zoom In icon  to zoom in on the Area of Interest.

The image in your Viewer should look something like this:

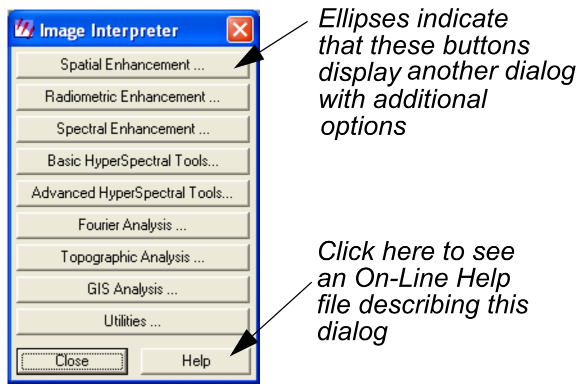


Subsetting an Image Without Snapping

1. Click the Interpreter icon on the ERDAS IMAGINE icon panel.

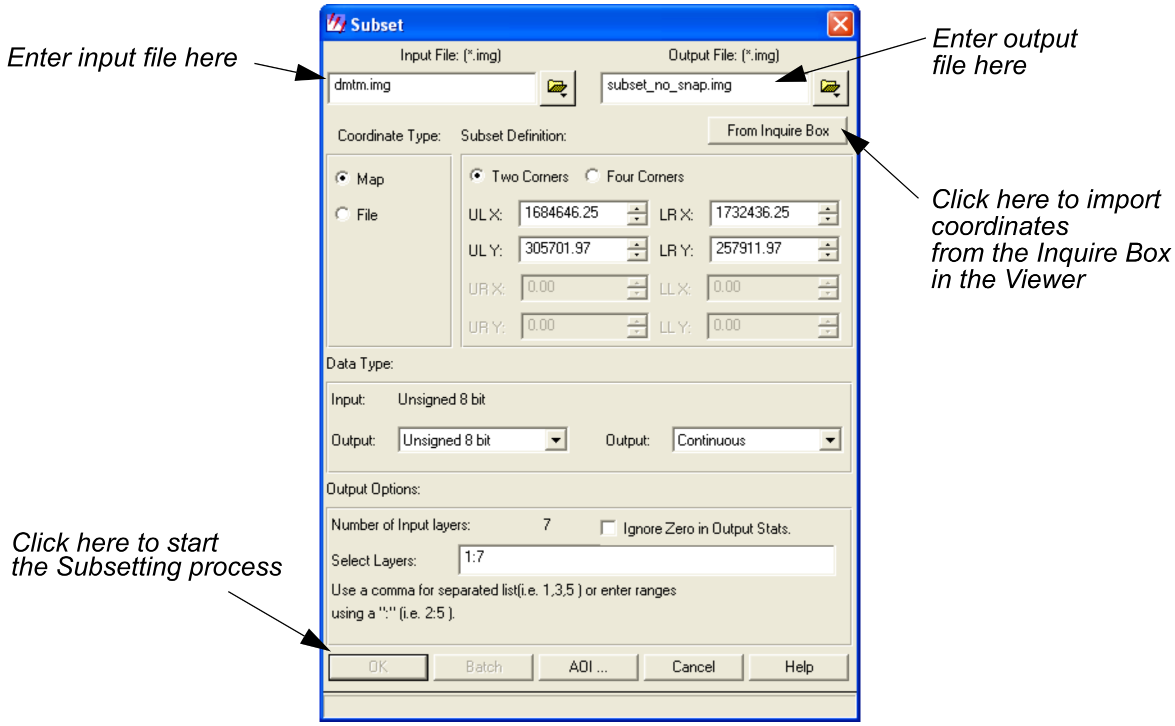


The **Image Interpreter** menu opens. Each of the buttons in the **Image Interpreter** menu displays a submenu of Image Interpreter functions



2. Select **Utilities** from the **Image Interpreter** menu and the **Utilities** menu opens.

3. Select **Subset** from the **Utilities** menu and the Subset dialog opens.



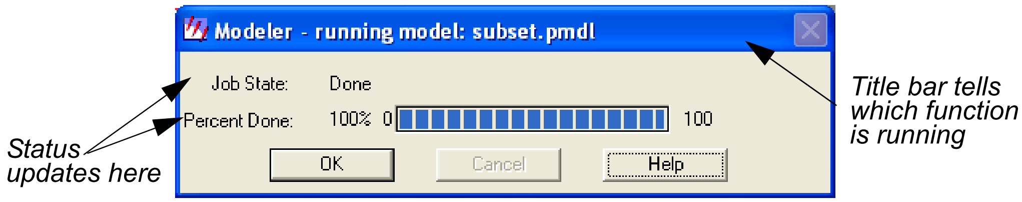
4. Under **Input File** in the Subset dialog, enter **dmtm.img**.

   This is a Landsat TM image of San Diego, California.

5. Under **Output File**, enter **subset_no_snap.img** in a directory where you have write permission.

6. Click **OK** to begin the Subsetting process.

   A Job Status bar displays, indicating the progress of the subsetting operation.

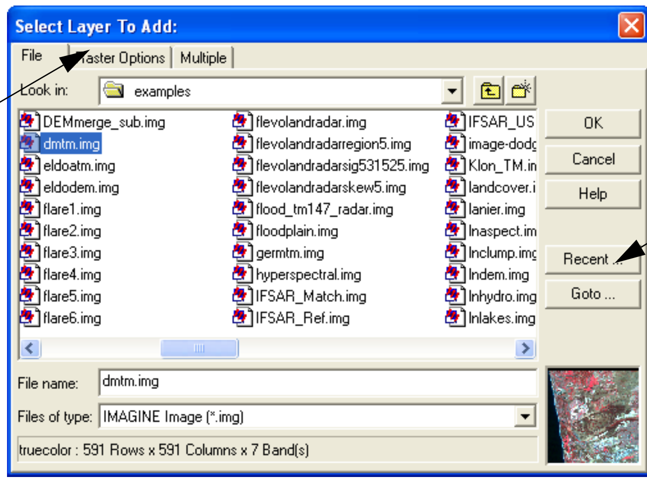


7. Depending on your eml **Preferences** (under **Session -> Preferences -> User Interface & Session -> Keep Job Status Box**), when the Job Status bar shows 100, indicating that the job is 100% done, you must either click **OK** to close the dialog or the dialog closes automatically.

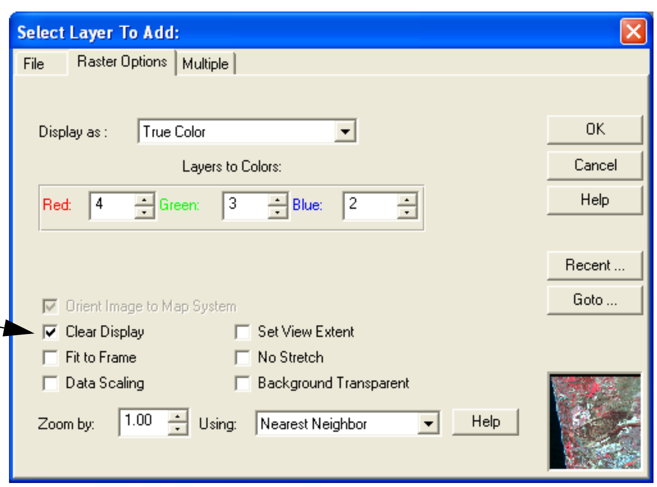
Displaying the Subset with the Original Data

1. The original image should still be displayed in the Viewer.
2. Select **File -> Open -> Raster Layer** from the menu bar on the Viewer.

   The Select Layer to Add dialog displays.



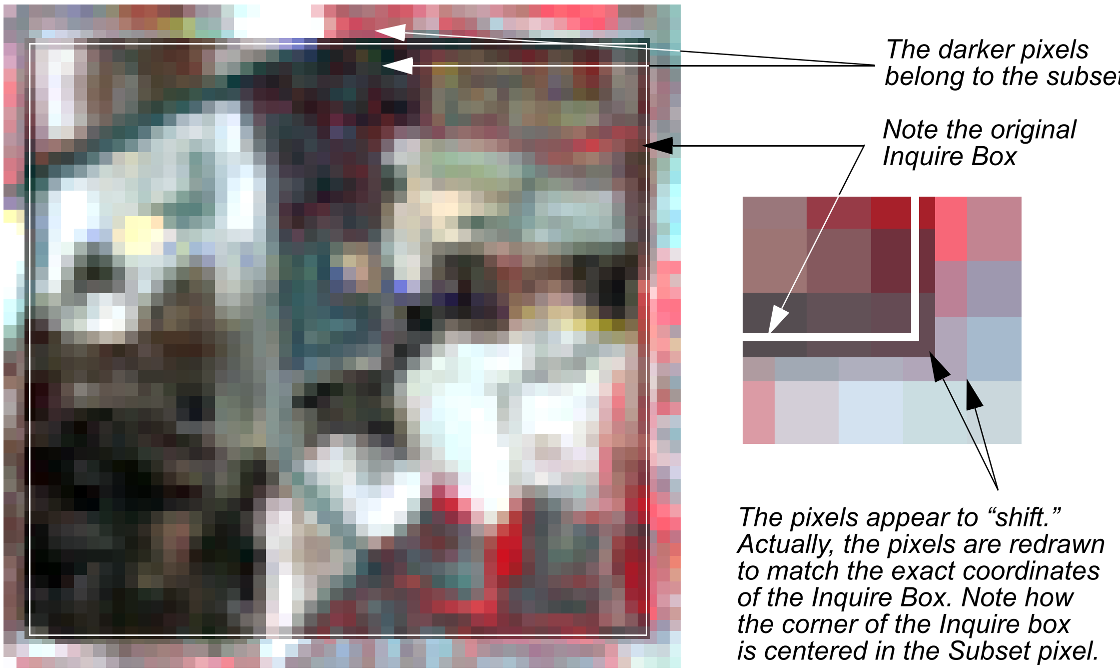
3. Click the **Recent** button to open a list of recently accessed files.
4. Select **subset_no_snap.img** from the List of Recent Files.
5. Click **OK** to dismiss the List of Recent Files.
6. Click the **Raster Options** tab.



7. Uncheck the **Clear Display** option so the new subset of the original image appears superimposed on the original image.

8. Click **OK**.

The subset displays in the Viewer over the original image.



When a subset of an image is taken from an Inquire Box that is not snapped to the pixel grid of the original image, the subset is drawn using the exact coordinates of the of the Inquire Box. Because the subset pixel grid differs slightly from the original image’s pixel grid, the subset image appears “shifted” from the original image.

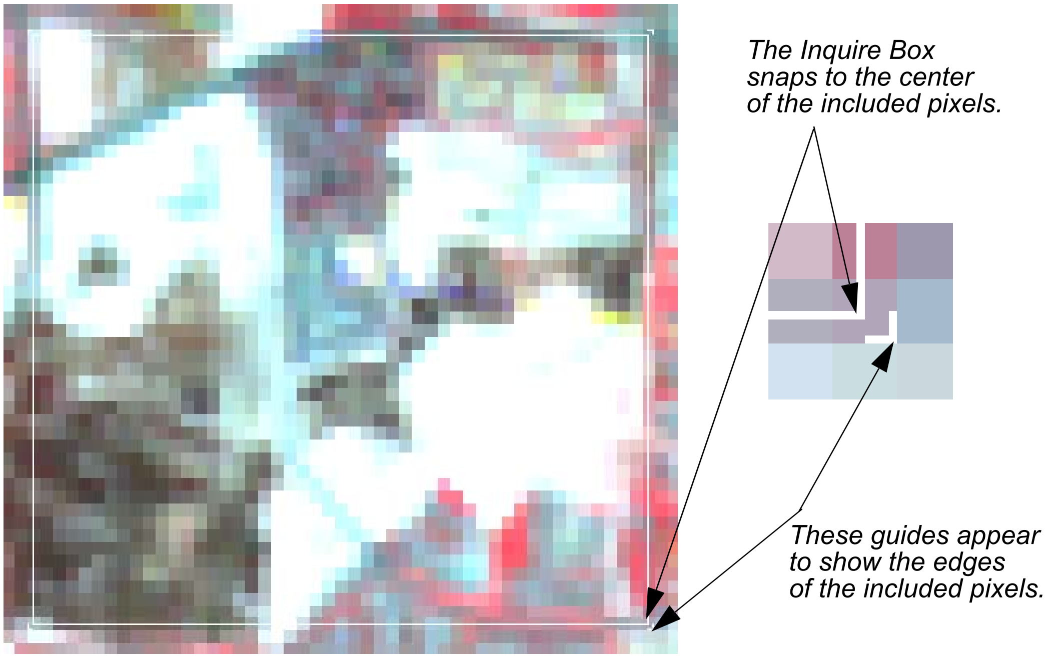
9. Click the Clear Top Layer icon to remove **subset_no_snap.img** from the Viewer.

The original image and the Inquire Box should still be displayed in the Viewer.

Subsetting an Image With Snap to Raster

1. In the Inquire Box dialog, click the **Snap to Raster** checkbox to make sure it is active (checked). Click **Apply**.

The Inquire Box snaps to the pixels centers and looks like this:



The coordinates in the Inquire Box dialog update to reflect the new corner coordinates.

2. In the Utilities dialog, click the **Subset** button. The Subset dialog displays.

3. Under **Input File**, enter **dmtm.img**.

4. In the **Output File**, enter **subset_snap.img** in a directory where you have write permission.

5. Click the **From Inquire Box** button.

   The coordinates in the **Subset Definition** area update to reflect the corner coordinates of the Inquire Box.

6. Click **OK** to start the Subsetting Process.

   The Subsetting Progress meter opens, displaying the progress of the subsetting.

Viewing the Snapped Subset

1. Select **File -> Open -> Raster Layer** from the menu bar in the Viewer.

   The Select Layer to Add dialog opens.

2. Click the **Recent** button.

The List of Recent Files dialog displays.

3. Select **subset_snap.img** from the list.

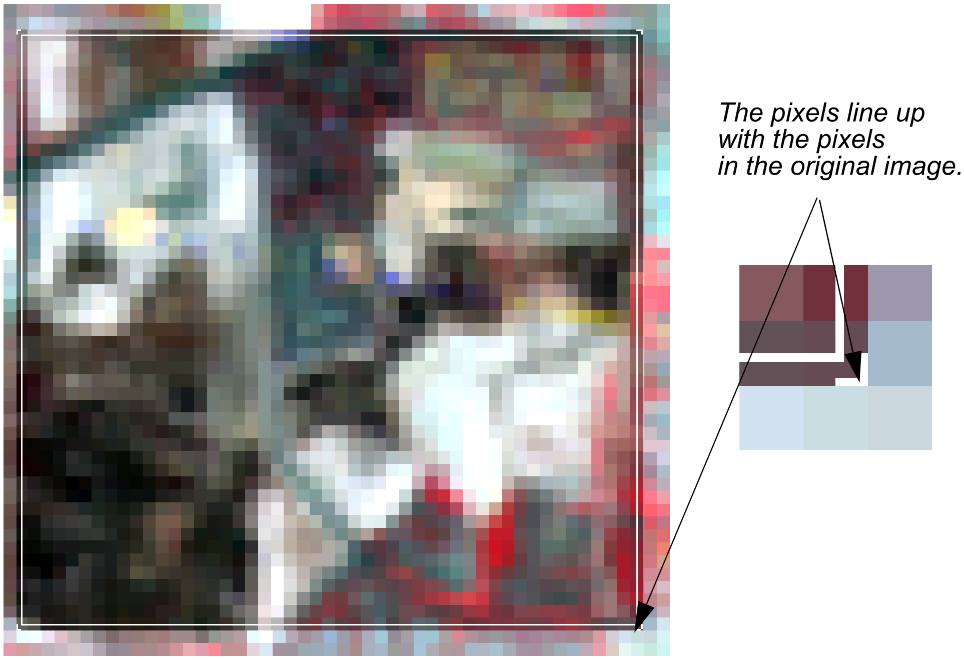
4. Click **OK** on the List of Recent Files to close the dialog.

5. Click the **Raster Options** tab in the Select Layer to Add dialog.

6. Deselect the **Clear Display** option.

7. Click **OK** to open **subset_snap.img** in the Viewer on top of dmtm.img.

The subsetted image displays in the Viewer.



Because the Inquire Box was snapped to the centers of the pixels before the image was processed, the pixels in the output file lines up exactly with the pixels in the original image.

8. Click **Close** on the Viewer.

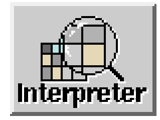
9. Click **Close** on the Utilities menu.

Apply Spatial Enhancement

ERDAS IMAGINE should be running with a Viewer open.

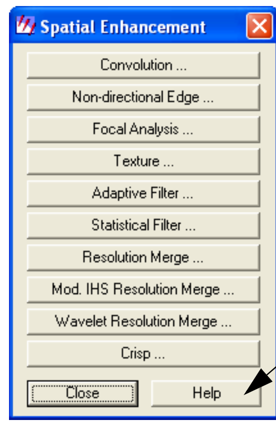
In this section, you use the convolution and crisp Spatial Enhancement functions to enhance images.

1. Click the Interpreter icon on the ERDAS IMAGINE icon panel.



The **Image Interpreter** menu opens.

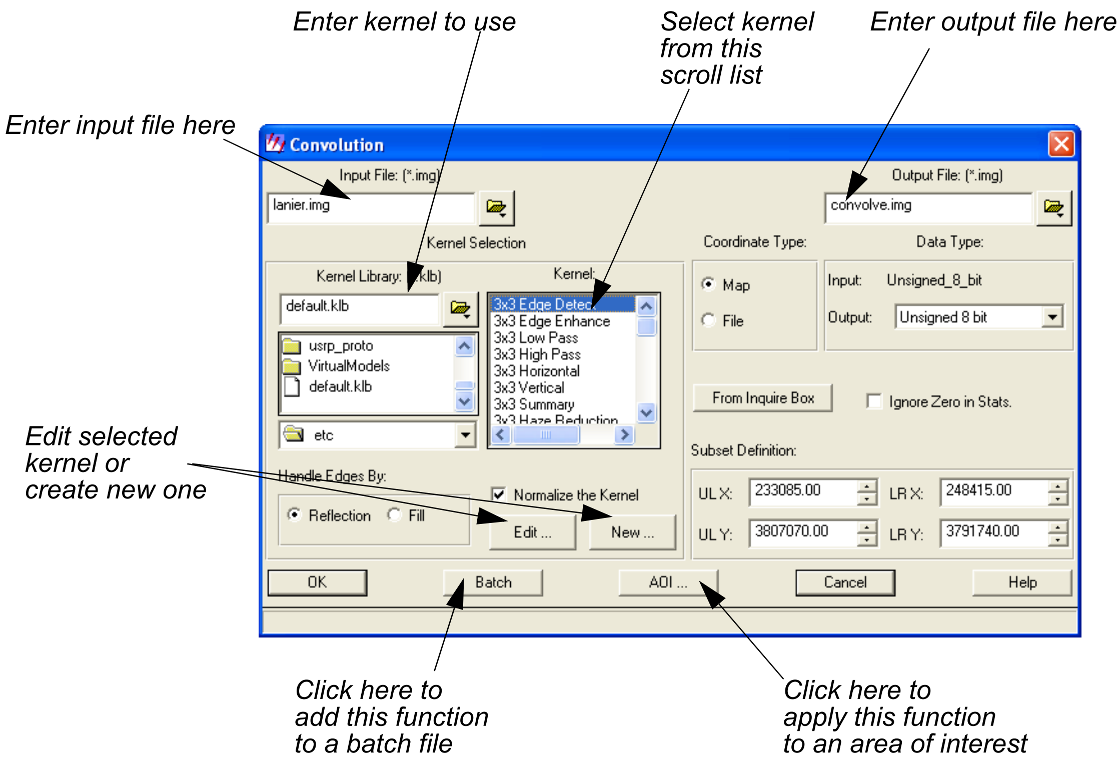
2. Select **Spatial Enhancement** from the **Image Interpreter** menu and the **Spatial Enhancement** menu opens.



Click here to see an On-Line Help file describing this dialog

Apply Convolution

1. Select **Convolution** from the **Spatial Enhancement** menu and the Convolution dialog opens.



This interactive Convolution tool lets you perform convolution filtering on images. It provides a scrolling list of standard filters and lets you create new kernels. The new kernels can be saved to a library and used again at a later time.

NOTE: Do not close the **Image Interpreter** *menu, as you continue using it in the next section.*

Select Input/Output Files

1. In the Convolution dialog, under **Input File**, enter **lanier.img**.

2. Under **Output File**, enter **convolve.img** in the directory of your choice. It is not necessary to add the .img extension when typing the file name—ERDAS IMAGINE automatically appends the correct extension.

   NOTE: Make sure you remember in which directory the output file is saved. This is important when you try to display the output file in a Viewer.

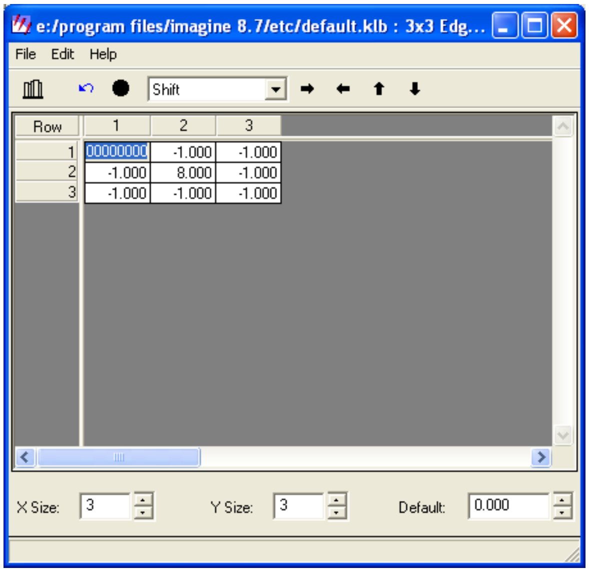
Select Kernel

Next, you must select the kernel to use for the convolution. A default kernel library containing some of the most common convolution filters is supplied with ERDAS IMAGINE. This library opens in the **Kernel Selection** part of this dialog.

1. From the scrolling list under **Kernel**, click **3x3 Edge Detect**.

2. Click the **Edit** button in the **Kernel Selection** box.

   The 3 × 3 Edge Detect dialog opens.



   For this exercise, you use the Kernel Editor to simply view the kernel used for the 3 × 3 Edge Detect filter. However, if desired, you could make changes to the kernel at this time by editing the CellArray.

3. Select **File -> Close** from the 3 × 3 Edge Detect dialog.

4. Click **OK** in the Convolution dialog.

   A Job Status dialog displays, indicating the progress of the function.

5. When the Job Status dialog shows that the process is 100% complete, click **OK**.

Check the File

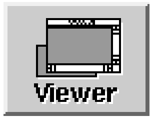
1. Select **File -> Open -> Raster Layer** from the Viewer menu bar.

   The Select Layer To Add dialog opens.

2. In the Select Layer To Add dialog under **Filename**, click **lanier.img**.

3. Click **OK** to display the file in the Viewer.

4. Open a second Viewer window by clicking on the Viewer icon on the ERDAS IMAGINE icon panel.



5. Select **File -> Open -> Raster Layer** from the menu bar of the Viewer you just opened.

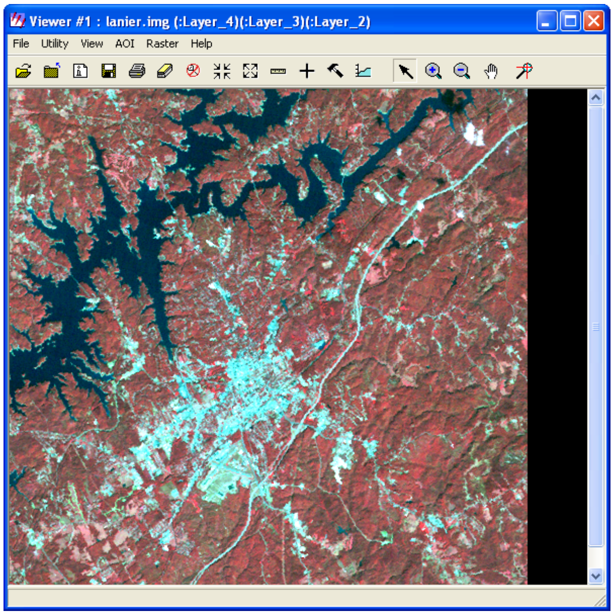
   The Select Layer To Add dialog opens.

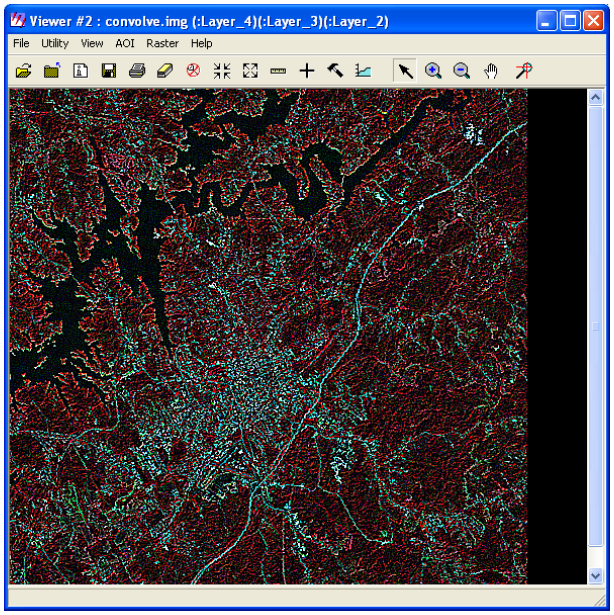
6. In the Select Layer To Add dialog under **Filename**, enter the name of the directory in which you saved **convolve.img**, and press the Enter key on your keyboard.

7. In the list of files, click **convolve.img** and then click **OK**.

   The output file generated by the Convolve function, **convolve.img**, displays in the second Viewer.

8. In the ERDAS IMAGINE menu bar, select **Session -> Tile Viewers** to compare the two files side by side.



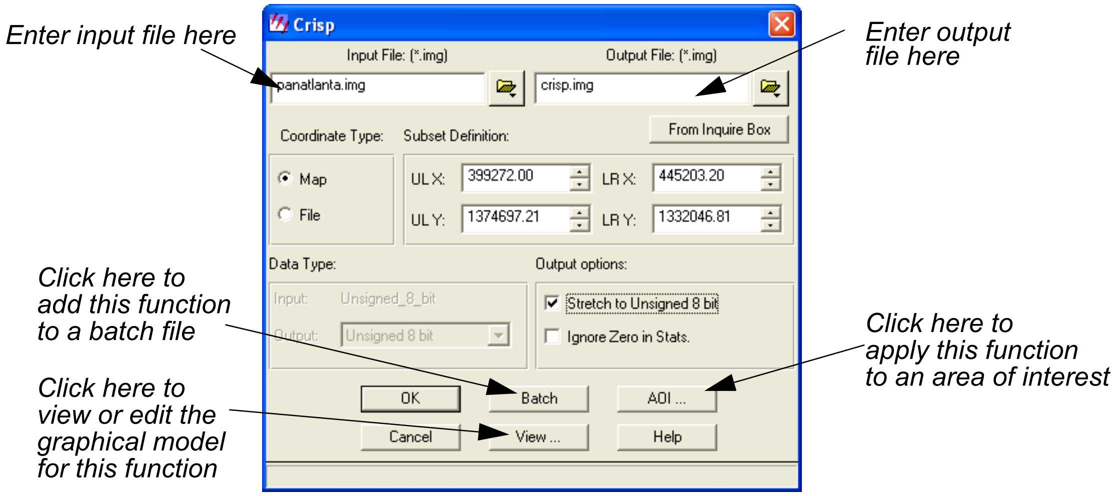


9. When you are finished comparing the two files, select **File -> Clear** from the menu bar of each Viewer.

Apply Crisp

1. Select **Crisp** from the **Spatial Enhancement** menu.

   The Crisp dialog opens.



The Crisp dialog is a good example of the basic Image Interpreter dialog. Other dialogs may have more prompts for inputs, depending on the function. Each dialog opens with default entries that are acceptable for use. These entries can be changed, if necessary, to achieve specific results.

2. Under **Input File** in the Crisp dialog, enter **panAtlanta.img**.

This is a SPOT panchromatic scene of downtown Atlanta, Georgia.

3. Under **Output File**, enter **crisp.img** in the directory of your choice as the output file.

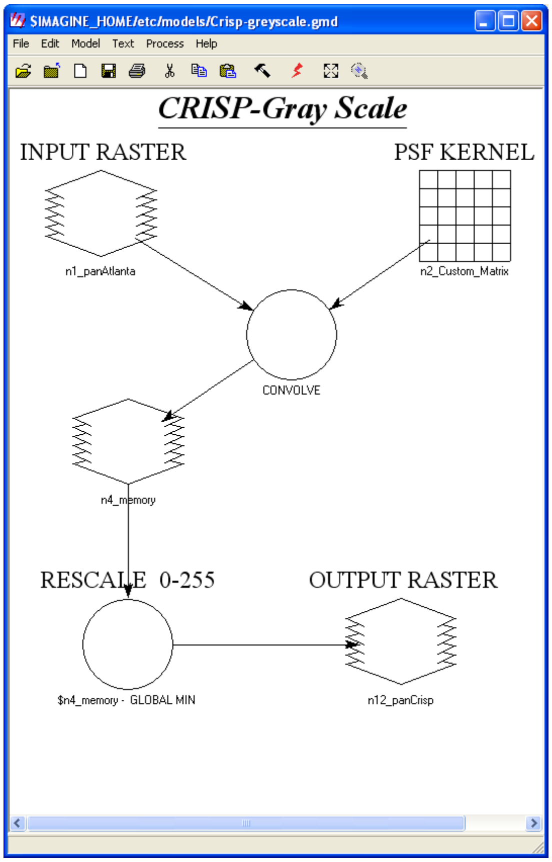
4. Under **Output Options** in the Crisp dialog, turn on the **Stretch to Unsigned 8 bit** checkbox by clicking on it.

This option produces the output file in unsigned 8-bit format, which saves disk space.

Use the View Option

1. Click the **View** button at the bottom of the Crisp dialog.

The Model Maker viewer window opens and displays the graphical model used for the Crisp function.



The **View** button in each Image Interpreter dialog lets you view the graphical model behind each function. If you want to change the model for a specific purpose, you can edit it through the Model Maker and apply the edited function to the image by running the model in Model Maker.

See the "Spatial Modeler" chapter in the **IMAGINE Professional Tour Guides** *for information on editing and running a model in Model Maker.*

2. Exit the Model Maker by selecting **File -> Close All**.

3. Click **OK** in the Crisp dialog to start the process.

A Job Status dialog opens, indicating the progress of the function.

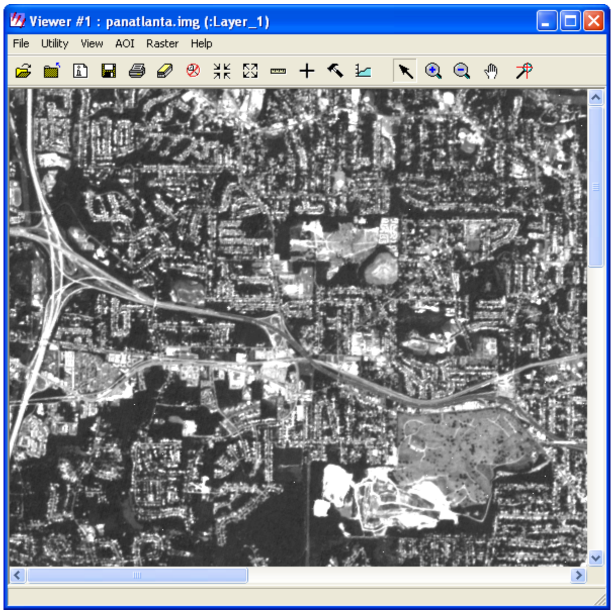
4. When the Job Status dialog shows that the process is 100% complete, click **OK**.

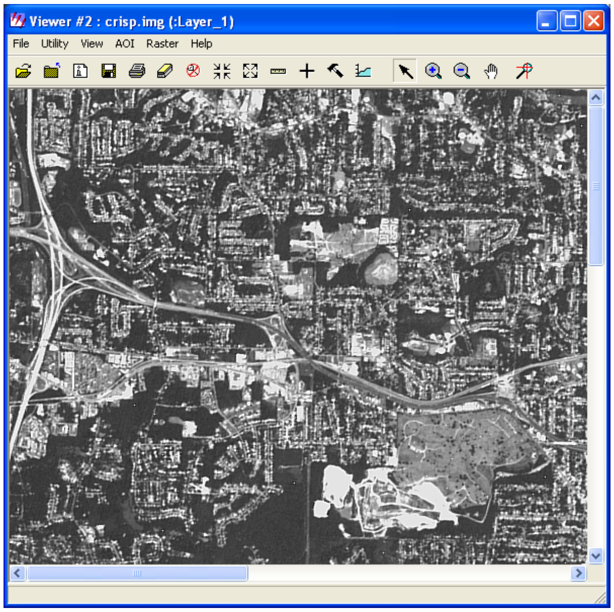
View Results

1. Display **panAtlanta.img** in a Viewer.

2. Display **crisp.img**, the output file generated by the Crisp function, in the other Viewer.

3. Note the differences between the two images; **crisp.img** appears to be sharper.





4. Use the Zoom In icon in the Viewer toolbar to zoom in for a closer look at the crispening of the image in **crisp.img**.

5. When you are through, close all the Viewers at once by selecting **Session -> Close All Viewers** from the ERDAS IMAGINE menu bar.

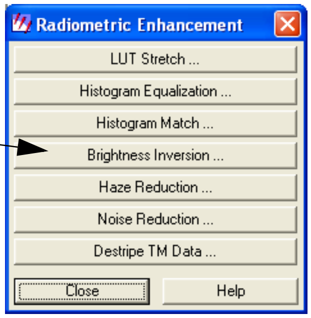
6. Click **Close** in the **Spatial Enhancement** menu.

   NOTE: Do not close the **Image Interpreter** *menu, as you continue using it in the next section.*

Apply Radiometric Enhancement

1. In the **Image Interpreter** menu, select **Radiometric Enhancement**.

   The **Radiometric Enhancement** menu opens.

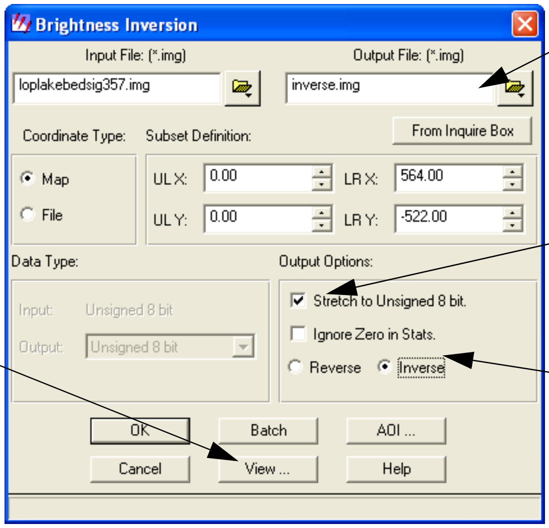


In this section, you use both the **Inverse** and **Reverse** options of the **Image Inversion** function to enhance images. Inverse emphasizes detail in the dark portions of an image. Reverse simply reverses the DN values.

Apply Brightness Inversion

1. In the **Radiometric Enhancement** menu, select **Brightness Inversion**.

   The Brightness Inversion dialog opens.



2. In the Brightness Inversion dialog under **Input File**, enter **loplakebedsig357.img**.
3. Under **Output File**, enter **inverse.img** in the directory of your choice.
4. Under **Output Options**, turn on the **Stretch to Unsigned 8 bit** checkbox by clicking on it.

5. Under **Output Options**, click **Inverse**.

6. Click **OK** in the Brightness Inversion dialog to start the process.

   A Job Status dialog displays, indicating the progress of the function.

Reverse

1. Select **Brightness Inversion** from the **Radiometric Enhancement** menu.

   The Brightness Inversion dialog opens.

2. In the Brightness Inversion dialog, enter **loplakebedsig357.img** as the input file.

3. Enter **reverse.img** in the directory of your choice as the **Output File**.

4. Turn on the **Stretch to Unsigned 8 bit** checkbox under **Output Options**.

5. Click **OK** in the Brightness Inversion dialog to start the process.

   A Job Status dialog displays, indicating the progress of the function.

View Changes

1. Open a Viewer and display **inverse.img**.

2. Right-hold within the Viewer and select **Fit Window to Image** from the **Quick View** menu.

   The Viewer changes size to bound the image data.

3. Select **View -> Split -> Split Vertical** from the Viewer menu bar.

   A second Viewer opens.

4. In the second Viewer, click the Open icon  (this is the same as selecting **File -> Open -> Raster Layer** from the Viewer menu bar).

   The Select Layer To Add dialog opens.

5. From the Select Layer To Add dialog, open the file **reverse.img**.

6. In the second Viewer, select **View -> Split -> Split Vertical** from the Viewer menu bar.

   A third Viewer opens.

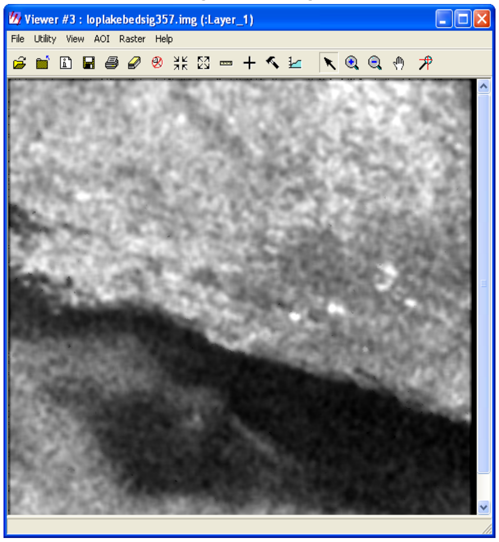
7. With your cursor in Viewer #3, press **Ctrl-r** on your keyboard (this is just another way to open a raster layer).

   The Select Layer To Add dialog opens.

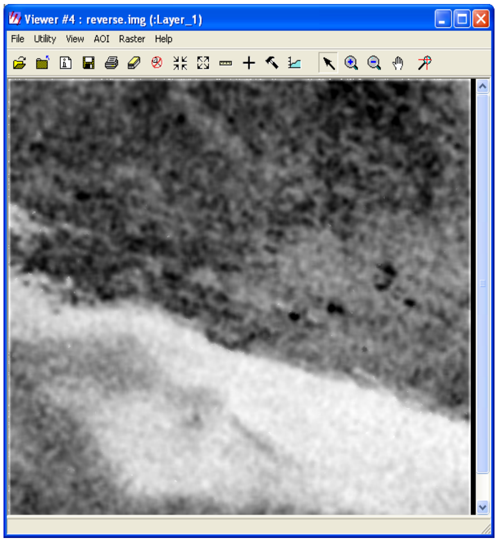
8. From the Select Layer To Add dialog, open the file **loplakebedsig357.img**.

9. Resize the Viewers on screen so that you can see all three Viewers. Note the differences between **reverse.img** and **inverse.img** compared to the original file.

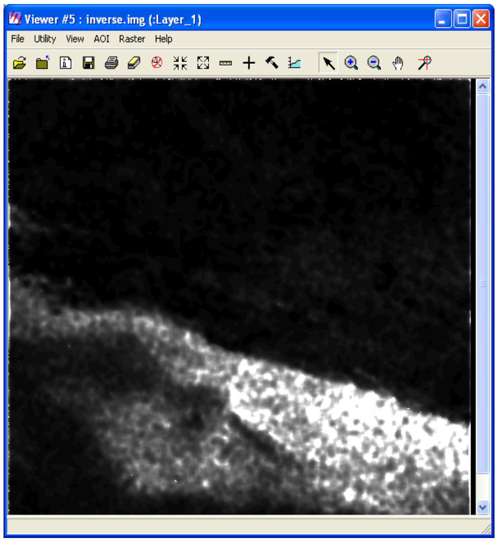
Original image



Reverse image



Inverse image



10. When you are through, close all three Viewers by selecting **Session -> Close All Viewers** from the ERDAS IMAGINE menu bar.

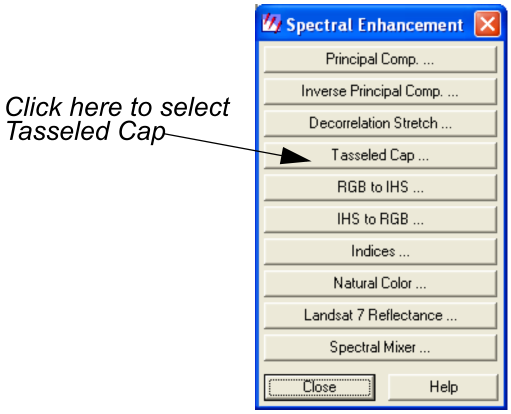
11. Click **Close** in the **Radiometric Enhancement** menu.

NOTE: Do not close the **Image Interpreter** *menu, as you continue using it in the next section.*

Apply Spectral Enhancement

1. In the **Image Interpreter** menu, click **Spectral Enhancement**.

The **Spectral Enhancement** menu opens.



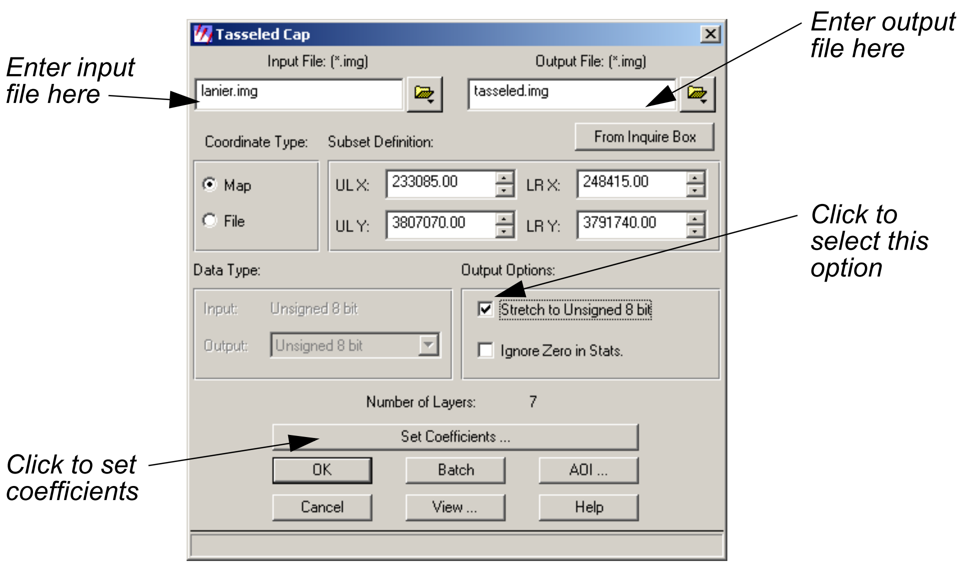
In this section, you use the following Spectral Enhancement functions:

- Tasseled Cap
- RGB to IHS
- IHS to RGB
- Indices

Use Tasseled Cap

1. In the **Spectral Enhancement** menu, select **Tasseled Cap**.

The Tasseled Cap dialog opens.



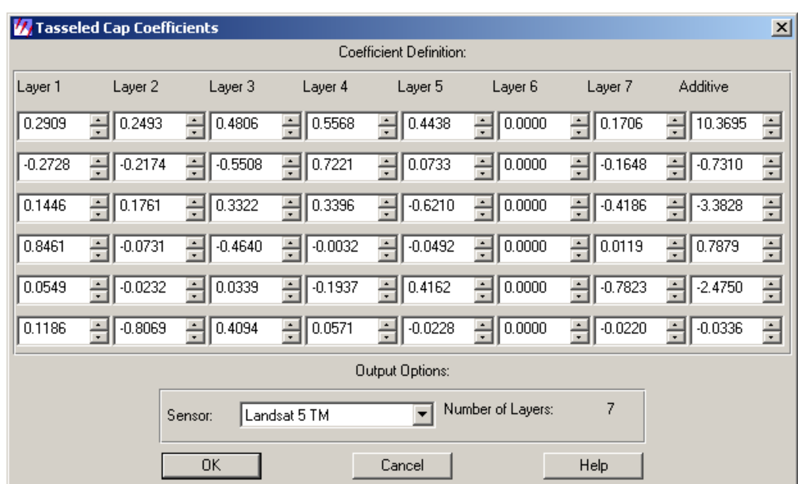
2. Under **Input File**, enter **lanier.img**. That image is a Landsat TM image of Lake Lanier, Georgia, which was obtained by the Landsat 5 sensor.

3. Enter **tasseled.img** in the directory of your choice as the **Output File** name.

4. Under **Output Options**, turn on the **Stretch to Unsigned 8 bit** checkbox by clicking on it.

5. Click **Set Coefficients**.

   The Tasseled Cap Coefficients dialog opens.



The coefficients that display are the standard default entries for Landsat 5 TM Tasseled Cap transformation. For this exercise, you use the default entries, although you may change these entries at any time.

6. Click **OK** in the Tasseled Cap Coefficients dialog.

7. Click **OK** in the Tasseled Cap dialog to start the function.

   A Job Status dialog opens to report the state of the job.

8. When the Job Status dialog indicates that the job is **Done**, click **OK**.

Check Results

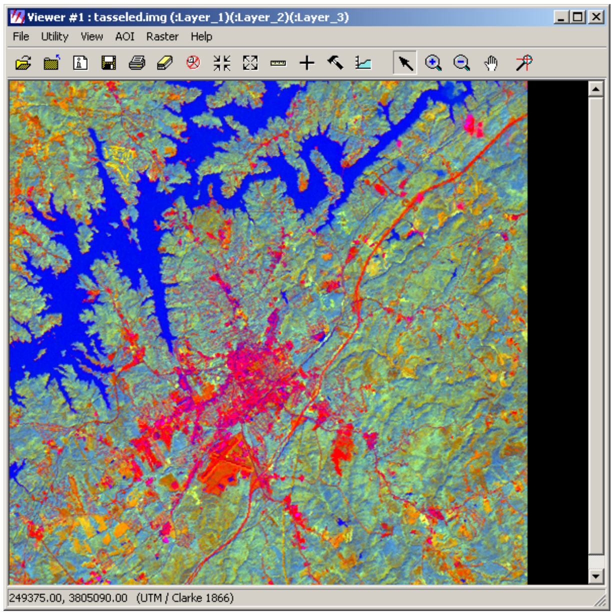
1. Open a Viewer and display **lanier.img**.

2. Open a second Viewer and then open the Select Layer To Add dialog by clicking on the Open icon in the Viewer toolbar.

3. In the Select Layer To Add dialog, enter the name of the directory in which you saved **tasseled.img**, press Enter on your keyboard, and then click **tasseled.img** in the file list to select it.

4. Click the **Raster Options** tab at the top of the Select Layer To Add dialog. Under **Layers to Colors**, use layer **1** as **Red**, layer **2** as **Green**, and layer **3** as **Blue**.

5. Click **OK** in the Select Layer To Add dialog.



The image, **tasseled.img**, shows a degree of brightness, greenness, and wetness, as calculated by the Tasseled Cap coefficients used.

- Layer 1 (red) = the brightness component (indicates areas of low vegetation and high reflectors)

- Layer 2 (green) = the greenness component (indicates vegetation)

- Layer 3 (blue) = the wetness component (indicates water or moisture)

6. When you are through, close the Viewers by selecting **Session -> Close All Viewers** from the ERDAS IMAGINE menu bar.

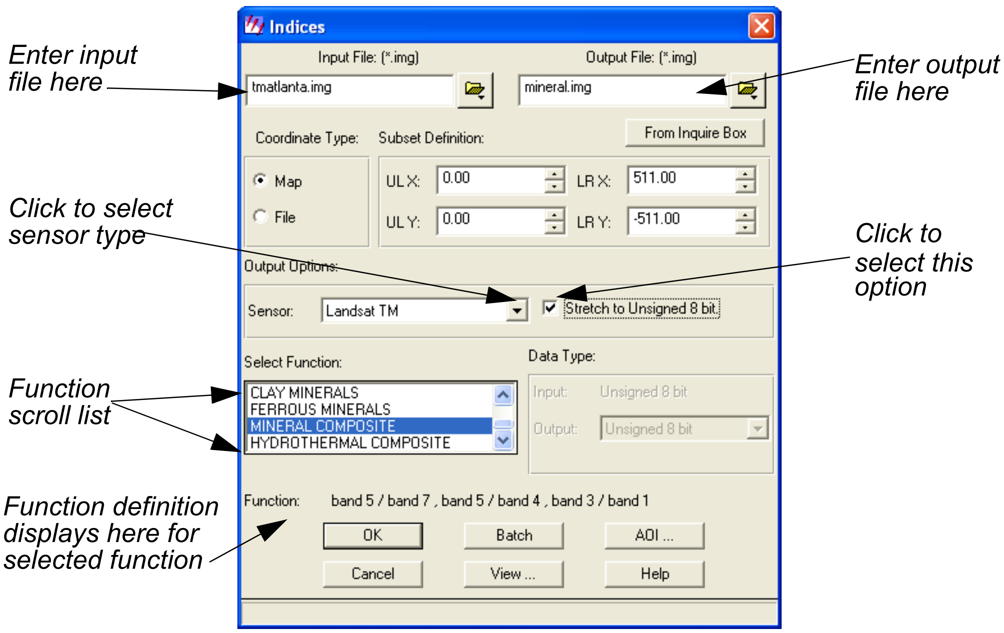
Use the Indices Function

Next, you apply a mineral ratio from the **Indices** function to a Landsat TM image. Such ratios are commonly used by geologists searching for specific mineral deposits in the earth.

For more information on this transformation, see the "Enhancement" chapter in the **ERDAS Field Guide Volume II**.

1. In the **Spectral Enhancement** menu, select **Indices**.

The Indices dialog opens.



2. Under **Input File**, enter **tmAtlanta.img**.

3. Enter **mineral.img** in the directory of your choice as the **Output File**.

4. Under **Select Function**, click **MINERAL COMPOSITE** in the scrolling list.

This index is a composite of three mineral ratios.

- Clay minerals = band 5 / band 7
- Ferrous minerals = band 5 / band 4
- Iron oxide = band 3 / band 1

NOTE: Notice how the selected function is defined beside the **Function** *label, underneath the* **Select Function** *scroll list.*

5. Under **Output Options**, turn on the **Stretch to Unsigned 8 bit** checkbox by clicking on it.

6. Click **OK** in the Indices dialog to start the process.

A Job Status dialog displays, indicating the progress of the function.

7. When the Job Status dialog indicates that the job is **Done**, click **OK**.

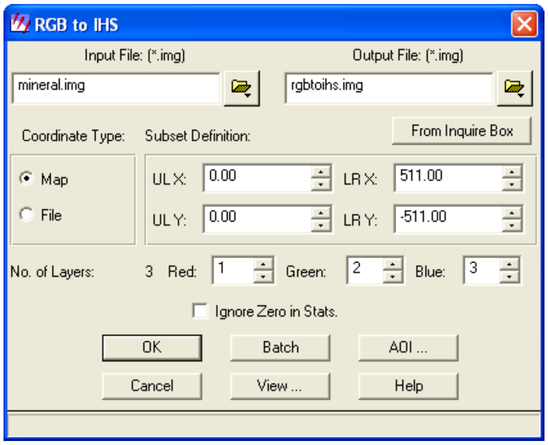
Choose RGB to IHS

Next, you use the **RGB to IHS** function (red, green, blue to intensity, hue, saturation) and the reverse **IHS to RGB** function to enhance the image information obtained by this mineral ratio.

The purpose of this function is to produce an input file for the IHS to RGB function.

1. Select **RGB to IHS** from the **Spectral Enhancement** menu.

The **RGB to IHS** dialog opens.



2. Enter the mineral ratio output from the previous exercise (**mineral.img**) as the **Input File**.

3. Enter **RGBtoIHS.img** (in the directory of your choice) as the **Output File**.

4. Click **OK** in the RGB to IHS dialog.

   A Job Status dialog displays, reporting the progress of the function.

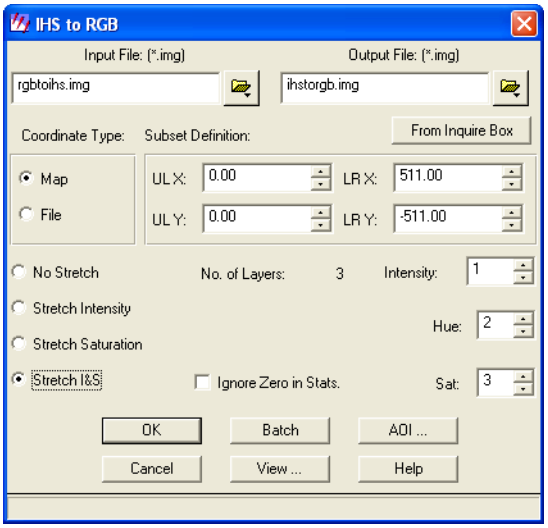
5. When the Job Status dialog indicates that the job is **Done**, click **OK**.

Choose IHS to RGB

Now, you convert the IHS image back into an RGB image.

1. Select **IHS to RGB** from the **Spectral Enhancement** menu.

   The IHS to RGB dialog opens.



2. In the IHS to RGB dialog, enter **RGBtoIHS.img** output from the previous exercise as the **Input File**.

3. Enter **IHStoRGB.img** as the **Output File** in the directory of your choice.

4. On the IHS to RGB dialog, click **Stretch I & S**.

   This option applies a global Min-Max contrast stretch to the Intensity and Saturation values in the image before converting.

5. Click **OK** in the IHS to RGB dialog.

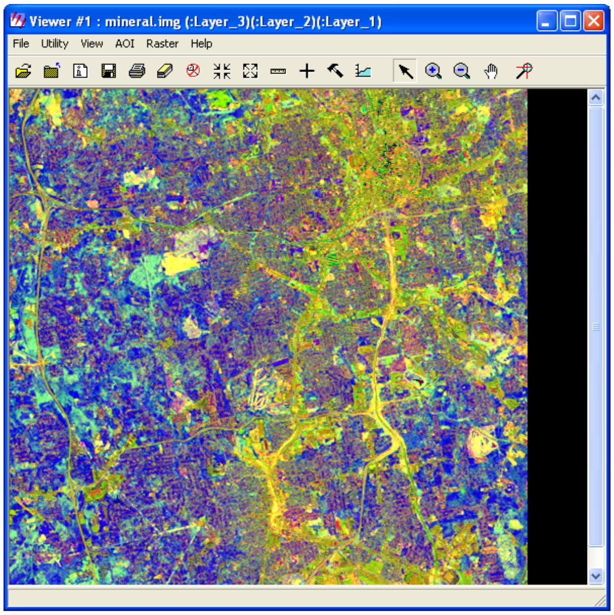
   A Job Status dialog displays, reporting the progress of the function.

6. When the Job Status dialog indicates that the job is **Done**, click **OK**.

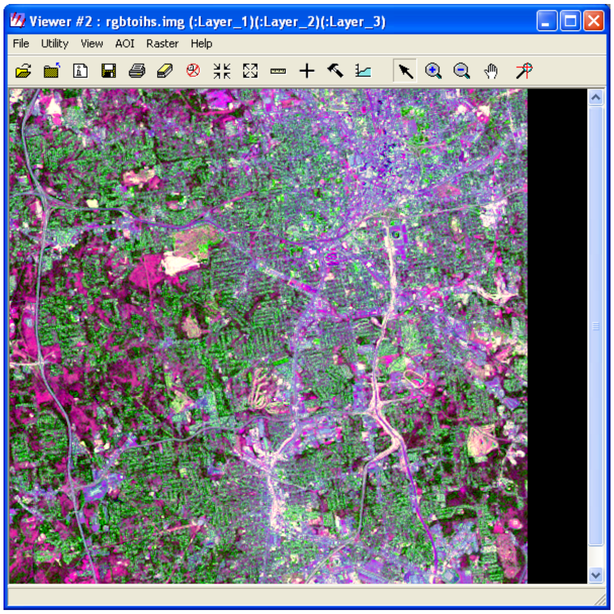
View the Results

1. Open three Viewers and then open the following files for comparison.

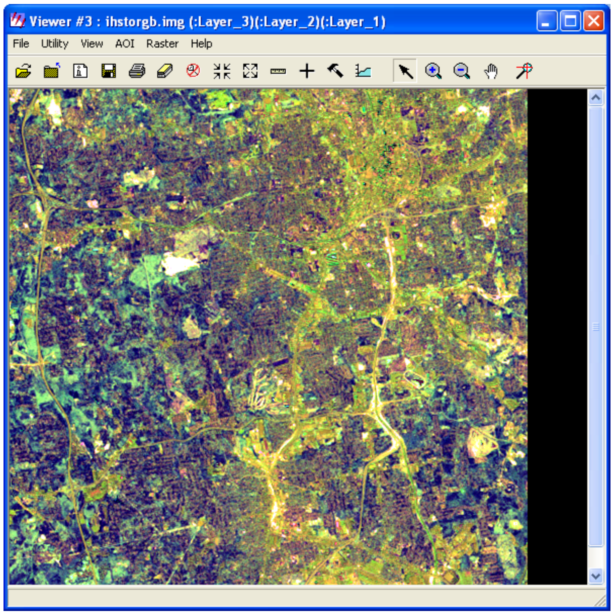
    - **mineral.img**—mineral ratio index. Proper interpretation can reveal the presence or absence of iron, clay, or ferrous minerals.



    - **RGBtoIHS.img**—red, green, and blue values converted to intensity, hue, and saturation values. This image does not appear similar to the input file. It is not meant for interpretation; it is only meant to produce an input for the IHS to RGB function.



- **IHStoRGB.img** (see special instructions below)—intensity, hue, and saturation values converted to red, green, and blue values (appears similar to **mineral.img**). The intensity and saturation (red and blue) values have been contrast-stretched for better interpretation.



In the Open Raster Layer dialog, when displaying **IHStoRGB.img***, be sure to load Layer 1 as Red, Layer 2 as Green, and Layer 3 as Blue. This is because the order of the layers was reversed in the transformation.*

2. When you are through comparing the files, close the Viewers by selecting **Session -> Close All Viewers** in the ERDAS IMAGINE menu bar.

3. Click **Close** in the **Image Interpreter** menu. Click **Close** in the Spectral Enhancement menu.

   The **Image Interpreter** and **Spectral Enhancement** menus close.

Wavelet Resolution Merge

Part of the Spatial Enhancement menu is the Wavelet Resolution Merge feature. This tour will cover the feature by using two images from the IMAGINE examples directory, **Quickbird_Pyramids_Pan.img** and **Quickbird_Pyramids_MS.img**. Both images are of the Egyptian pyramids and are courtesy of DigitalGlobe. Because both of these images have been captured by the same satellite, they are inherently coregistered. Before performing Wavelet Resolution Merge on your own images, you should precisely coregister them to the subpixel level. For more information on how to do this, see the tour for Subpixel Coregistration at the end of the chapter on Polynomial Rectification.

In addition to being precisely coregistered, your images must also have the same footprint on the ground. Wavelet Resolution Merge will not produce the expected results if one image covers more ground than the other image. In that case the images are rewritten to fit one another by the geographic footprint rather than actual map coordinates causing pixel replication.

1. Open a Viewer, and click **File -> Open -> Raster Layer** or the open file icon to display the **Select Layer to Add** dialog.

2. Hold down the Ctrl key or the Shift key and select **QuickBird_Pyramids_MS.img** and **Quickbird_Pyramids_Pan.img**.

3. Click the **Raster Options** tab, and click **Clear Display** to deselect it. Click **Fit to Frame**, and **OK**.

   You may want to rotate the image in the Viewer by clicking **View -> Rotate**. A dialog will appear giving you degree and rotation direction options. Whether or not to rotate the image is up to you.

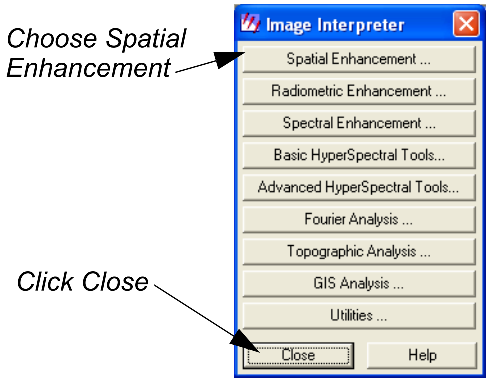
4. In the Viewer menu, click **Utility -> Swipe** to open the Viewer Swipe dialog.

5. In the Viewer Swipe dialog, take a few minutes to manually move the swipe feature over the images both horizontally and vertically, so you can see how precisely they are matched. You can also use the Auto Mode and adjust its speed to your preference. When you are finished, click **Cancel** in the Viewer Swipe dialog.

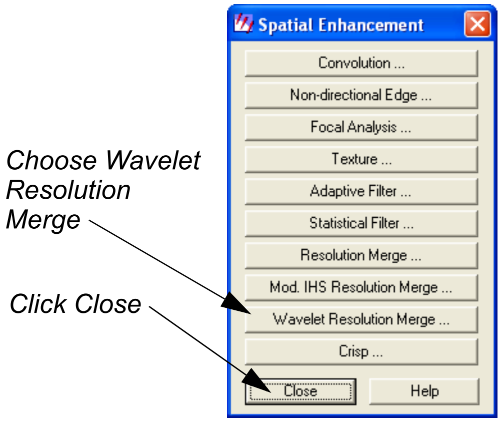
6. Next, click the Zoom In icon, and zoom in on some features that interest you. This exercise also gives you a good idea of how well the two images are matched. You can use the Zoom In and Zoom Out icons to adjust your view. When you are finished, click the Reset Window Tools or arrow icon to return to the arrow cursor.

7. Click the Interpreter button in the IMAGINE toolbar.

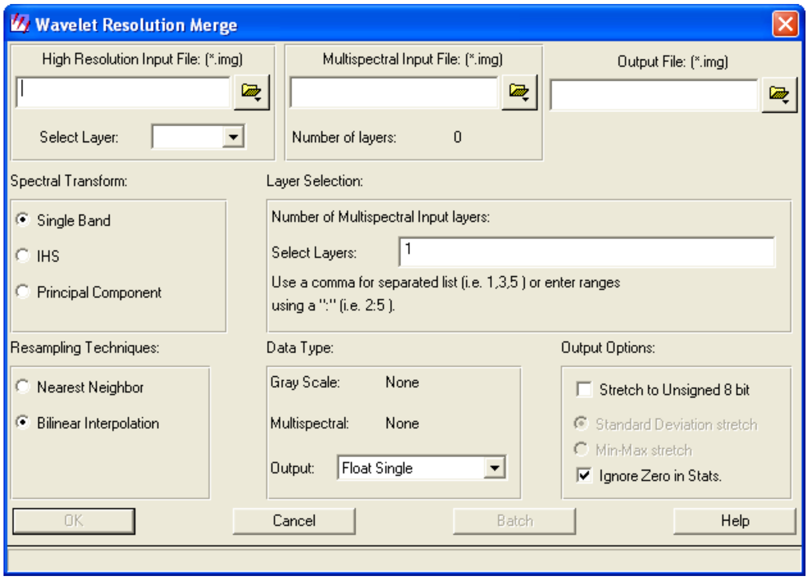
   The Image Interpreter dialog opens.



8. Select **Spatial Enhancement**, and click **Close** in the Image Interpreter dialog after the Spatial Enhancement dialog opens.



9. Select **Wavelet Resolution Merge**. After the Wavelet Resolution Merge dialog opens, click **Close** in the Spatial Enhancement dialog.



10. Click the open file icon, and select **Quickbird_Pyramids_Pan.img** for the High Resolution Input File.

11. Click the open file icon, and select **Quickbird_Pyramids_MS.img** for the Multispectral Input File.

12. Click the open file icon, navigate to the directory where you want to store your merged image, and type the name of the new file.

13. Under **Layer Selection**, you can type in the range of bands to use in the **Select Layers** box. For this exercise, you will leave the range at 1:4.

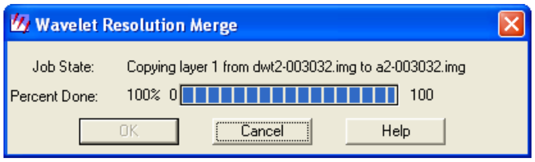
14. Leave the **Spectral Transform** at **Single Band**.

NOTE: The IHS technique is limited to 3 bands, and there are 4 to be considered for this merge. If you chose IHS instead of Single Band, there would be distortions. Single band will use all 4 bands sequentially.

15. Leave the **Resampling Technique**, **Data Type**, and **Output Options** at their defaults.

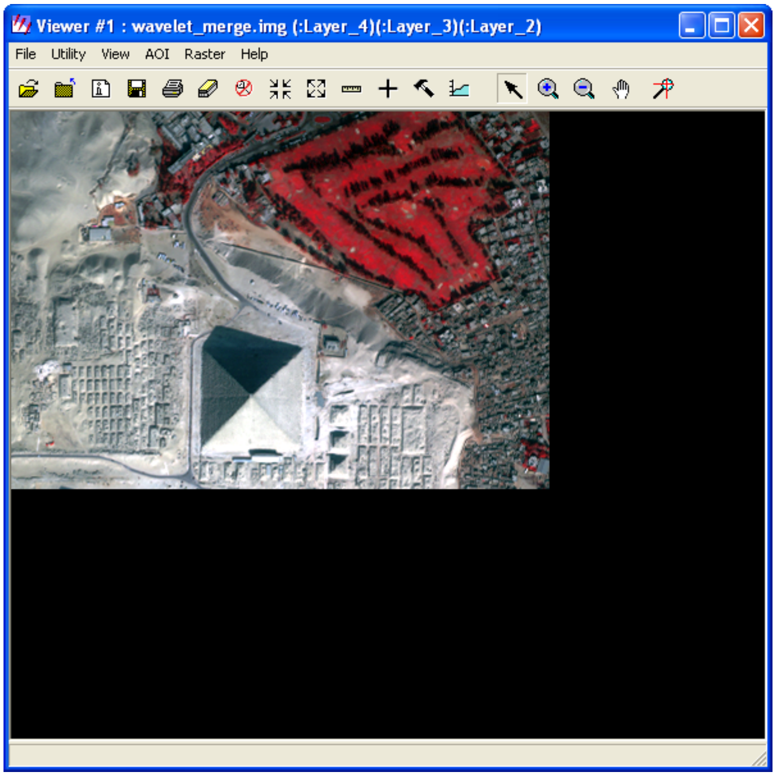
16. Click **OK**.

The Wavelet Resolution Merge processing dialog appears.



17. Click **OK** when the button is highlighted and the Job State is Done.

18. Open a Viewer and display both **Quickbird_Pyramids_MS.img** and your new merged image. Make sure you click **Clear Display** in **Raster Options** to deselect it before adding each image.



19. Using the Swipe and Zoom tools, check the accuracy of the newly merged image.

Orthorectification

Introduction

Rectification is the process of projecting the data onto a plane and making it conform to a map projection system. Assigning map coordinates to the image data is called georeferencing. Since all map projection systems are associated with map coordinates, rectification involves georeferencing.

The orthorectification process removes the geometric distortion inherent in imagery caused by camera/sensor orientation, topographic relief displacement, and systematic errors associated with imagery. Orthorectified images are planimetrically true images that represent ground objects in their true “real-world” X and Y positions. For these reasons, orthorectified imagery has become accepted as the ideal reference image backdrop necessary for the creation and maintenance of vector data contained within a GIS.

By performing space resection, the effects of camera/sensor orientation have been considered and removed. By defining a DEM or constant elevation value (ideal for use in areas containing minimal relief variation), the effects of topographic relief displacement can be considered and removed.

For information on bundle block adjustment, see the LPS Project Manager User’s Manual and LPS Automatic Terrain Extraction User’s Manual.

Approximate completion time for this tour guide is 30 minutes.

Rectify a Camera Image

In this tour guide, you orthorectify a camera image of Palm Springs, California, using a NAPP (National Aerial Photography Program) photo.

Perform Image to Image Rectification

In rectifying the camera image, you use these basic steps:

- Display a camera image.
- Start the Geometric Correction Tool.
- Enter the Camera model properties.
- Record GCPs.

- Resample or calibrate the image.

Resampling vs. Calibration

Resampling

Resampling is the process of calculating the file values for the rectified image and creating the new file. All of the raster data layers in the source file are resampled. The output image has as many layers as the input image.

ERDAS IMAGINE provides these widely-known resampling algorithms:

- Nearest Neighbor
- Bilinear Interpolation
- Cubic Convolution
- Bicubic Spline

Calibration

Instead of creating a new, rectified image by resampling the original image based on the mathematical model, calibrating an image only saves the mathematical model into the original image as a piece of auxiliary information. Calibration does not generate new images, so when the calibrated image is used, the math model comes into play as needed.

For example, if you want to see the calibrated image in its rectified map space in a Viewer, the image can be resampled on the fly based on the math model, by selecting the **Orient image to map system** option in the Select Layer To Add dialog.

A major drawback to image calibration is that the processes involved with the calibrated image is slowed down significantly if the math

Prepare

ERDAS IMAGINE should be running and a Viewer open.

You must have write permission in a file if you wish to calibrate it.

1. In a command shell or Windows Explorer, navigate to the <<ERDAS_Data_Home>/examples directory.
2. Copy the file **ps_napp.img** to a directory in which you have write permission and at least 10 Mb of space.

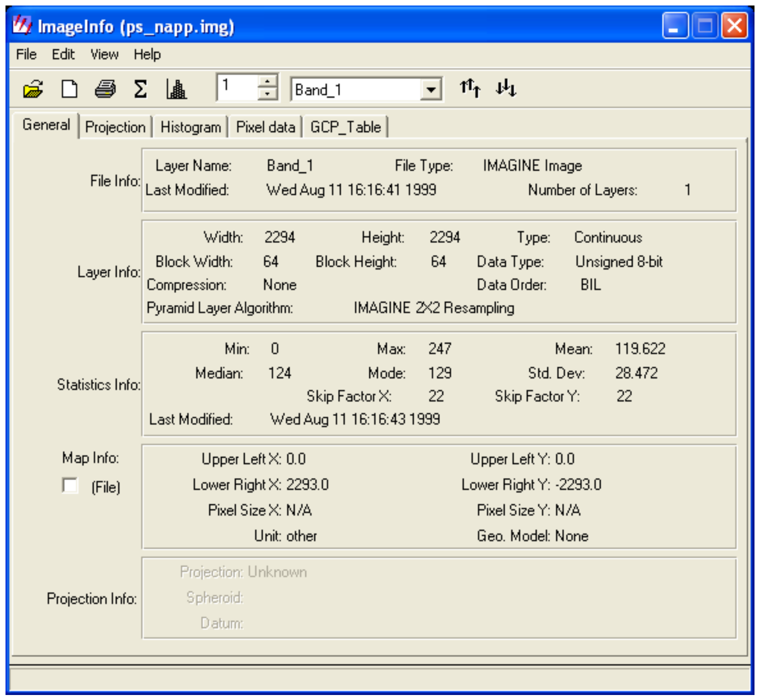
3. Set the permissions on **ps_napp.img** to read, write, execute on UNIX by using the command `chmod 777 ps_napp.img`, or on Windows by right-clicking on the file, selecting **Properties** and deselecting the **Read-only** option.

   Next, you should verify that **ps_napp.img** has no map or projection information.

4. Select **Tools -> Image Information** from the ERDAS IMAGINE menu bar.

5. Click the Open icon , then navigate to the location where you saved **ps_nappimg**.

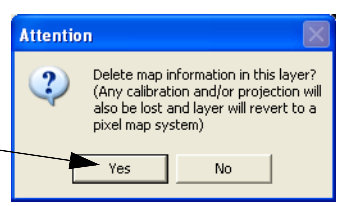
6. Select the file, then click **OK** in the Image Files dialog to open your copy of **ps_napp.img**.



7. Select **Edit -> Delete Map Model**.

8. Click **Yes** in the Attention dialog that opens.

Click Yes—you will apply a projection system to the image



9. Select **File -> Close** to dismiss the ImageInfo dialog.

Review Image Information

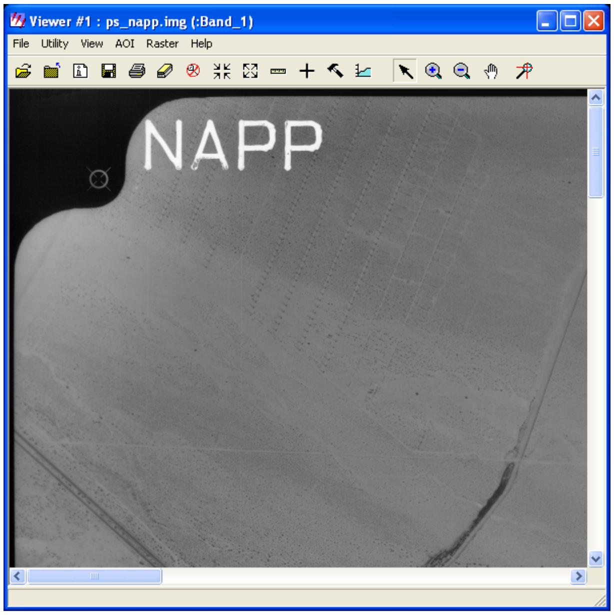
1. Select **File -> Open -> Raster Layer** from the Viewer menu bar, or click the Open icon  on the Viewer toolbar.

   The Select Layer To Add dialog opens.

2. In the Select Layer To Add dialog, select **ps_napp.img** from the directory into which you copied it.

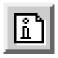
3. Click **OK** in the Select Layer To Add dialog to display the camera image in the Viewer.

   The file **ps_napp.img** opens in the Viewer. The Viewer image displays with a view of the upper-left corner of the photo, as shown in the following picture:

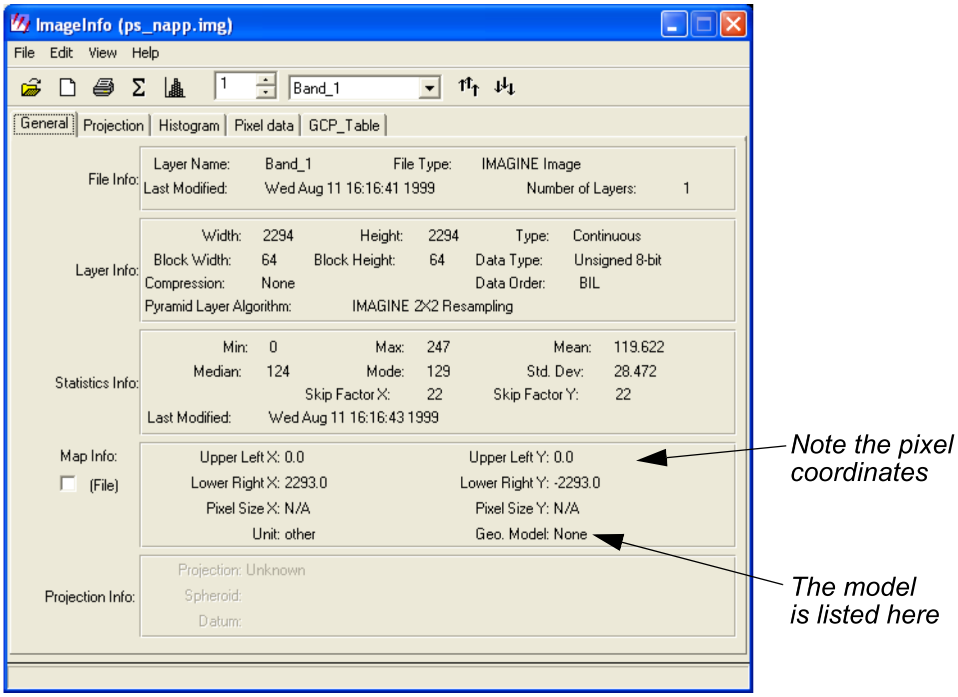


Check for Map Model

Before you continue with geometric correction, you must first make sure that the image does not already have a map model.

1. On the Viewer toolbar, click the ImageInfo icon  .

   The ImageInfo dialog opens.



2. Look in the **Map Info** section by **Geo. Model**. If **Geo. Model** says **Camera**, you must delete the map model, therefore, proceed to **step 3.**. If there is no model, select **File -> Close** to dismiss the ImageInfo dialog, then proceed to **"Perform Geometric Correction"**.

3. Select **Edit -> Delete Map Model** from the ImageInfo menu bar.

4. Select **File -> Close** from the ImageInfo menu bar.

Redisplay the file

1. Click the Close icon  in the Viewer currently displaying **ps_napp.img**.

2. Click the Open icon , and select **ps_napp.img** from the directory in which you saved it.

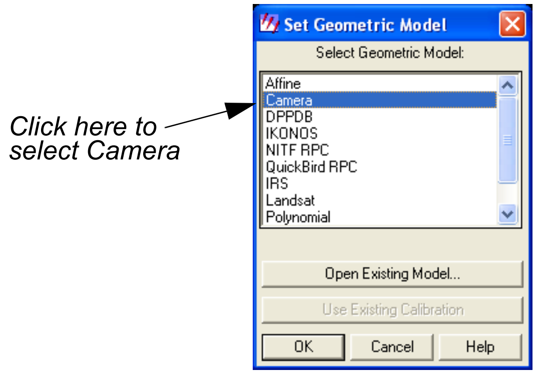
3. Move your cursor around the image and note the small coordinates in the status area.

   The small coordinates are pixel coordinates, not map coordinates. You can now proceed with geometric correction.

Perform Geometric Correction

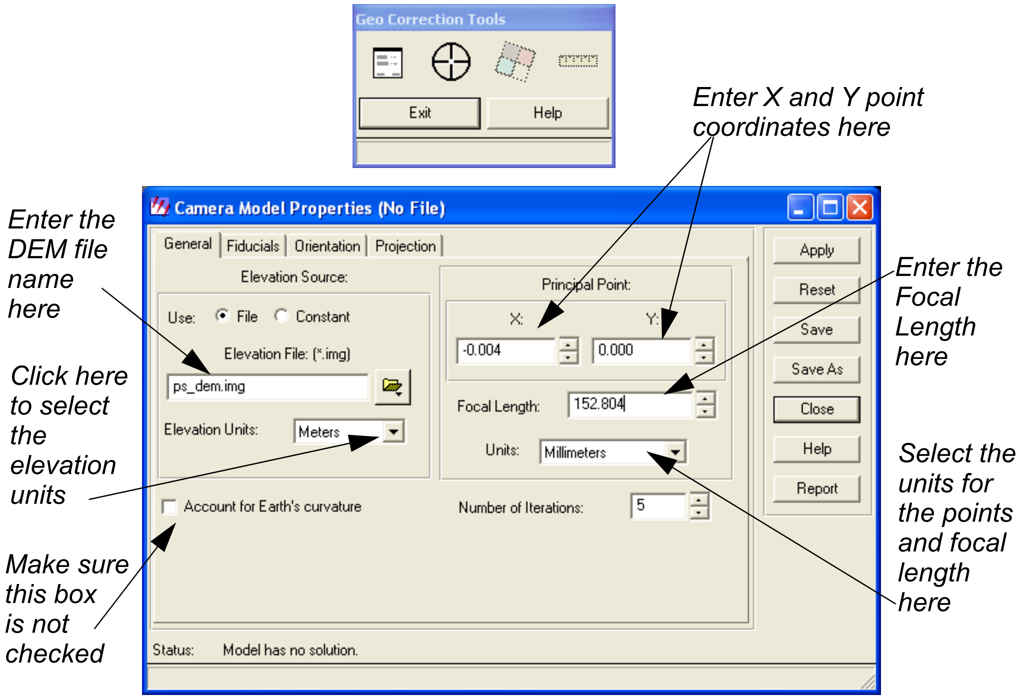
1. Select **Raster -> Geometric Correction** from the Viewer menu bar.

The Set Geometric Model dialog opens.



2. In the Set Geometric Model dialog, click **Camera**, and then click **OK**.

The Geo Correction Tools and Camera Model Properties dialogs open.



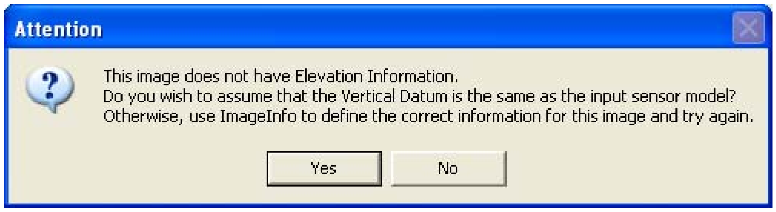
Set Camera Model Properties

1. In the Camera Model Properties dialog, enter the DEM file (**ps_dem.img**) under **Elevation File**.

The file **ps_dem.img** is located in the <<ERDAS_Data_Home>/examples directory.

NOTE: Upon request, the data provider supplies the camera calibration certificate with the film at the time of purchase. This certificate provides the information needed for **step 3.** *and* **step 4.**.

2. Click **Yes** in the Attention window that opens.



3. In the Camera Model Properties dialog under **Principal Point**, enter **-0.004** for **X** and accept **0.000** as the default for **Y**. Then enter **152.804** for the **Focal Length**.

   NOTE: From the camera calibration certificate, there may be several possible types of the Principal Point coordinates. The Principal Point of Symmetry is preferable.

4. In **Units** under **Principal Point**, accept the default of **Millimeters**.

   NOTE: The **X** *and* **Y Principal Point** *coordinates,* **Focal Length**, *and* **Fiducial Film** *coordinates must all be entered in the same units.*

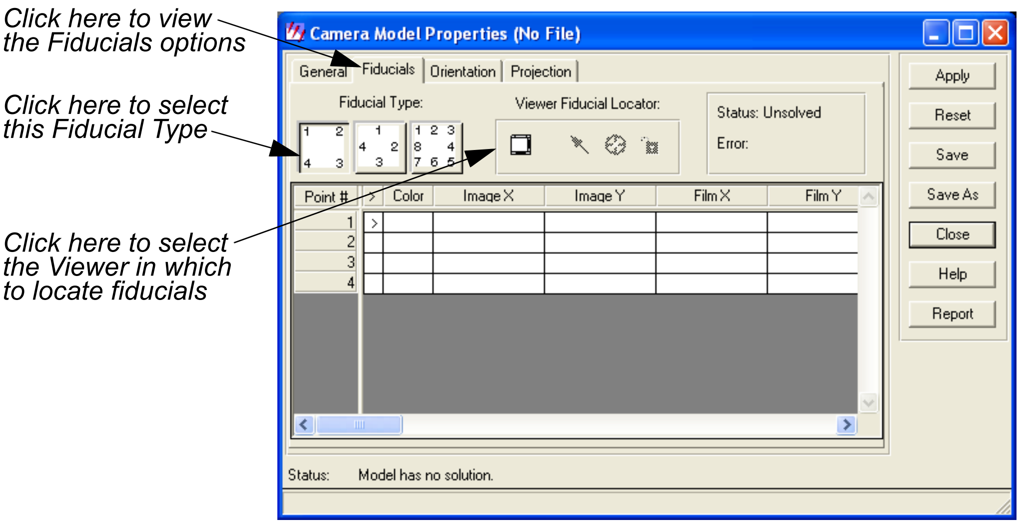
5. For this example, make sure that the **Account for Earth's curvature** checkbox not selected.

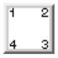
   You should only account for the Earth's curvature when using small-scale images or when it is necessary to take this factor into account. Alternately activating and deactivating this option (and then clicking **Apply***) allows you to observe changes to the RMS error. Accounting for the Earth's curvature slows down the rectification process.*

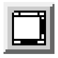
Edit Fiducials

1. Click the **Fiducials** tab at the top of the Camera Model Properties dialog.

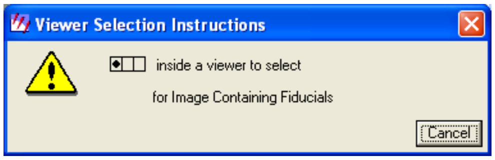
   The Fiducial options display.



2. Under **Fiducial Type**, click the Four Corners fiducial icon  .

3. Under **Viewer Fiducial Locator**, click the Toggle icon  .

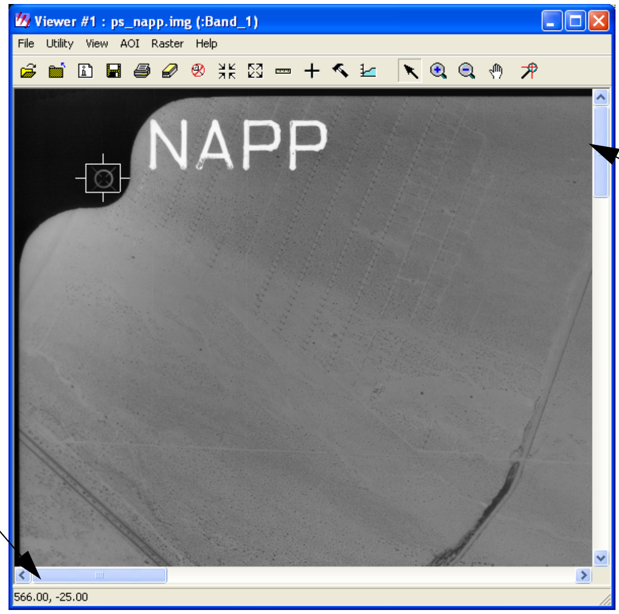
4. Follow the instructions by clicking in the Viewer that contains **ps_napp.img**.



A link box opens in the first Viewer, and the Chip Extraction Viewer also displays (the second Viewer).

5. In the first Viewer, drag the link box to the fiducial in the image you want to digitize (as illustrated in the following example). Place the center of the link box on the fiducial at the center of the area (where the crosshair intersects).

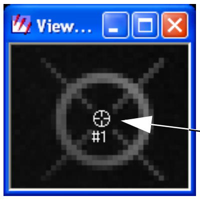
NOTE: Identifying the fiducial may sometimes require Breakpoint/LUT adjustments.



The second Viewer displays the point in the image that you have chosen with the link box.

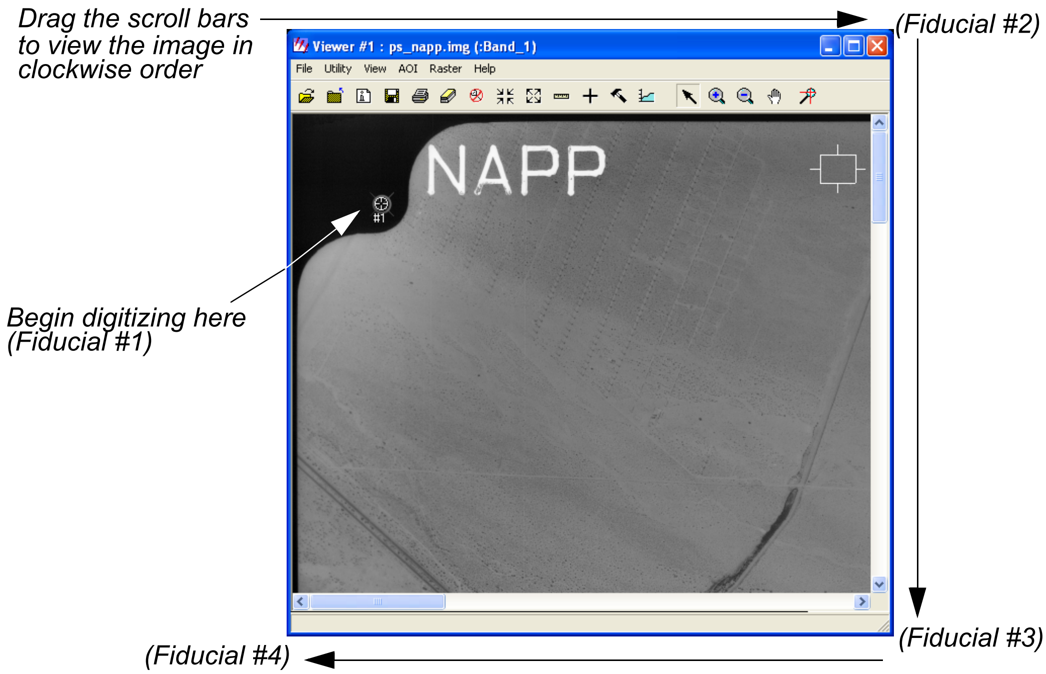
6. In the Camera Model Properties dialog, click the Place Image Fiducial icon  .

7. Move your cursor into the Chip Extraction Viewer (the second Viewer), and click the center area where the crosshair intersects.



The point coordinates display under **Image X** and **Image Y** in the Fiducials CellArray of the Camera Model Properties dialog.

8. Create three more fiducials by repeating **step 5.** and **step 6.** in the three other corners of the image in the first Viewer. Move clockwise around the image in the Viewer, using the Viewer scroll bars, as shown in the following illustration:



Enter Film Coordinates

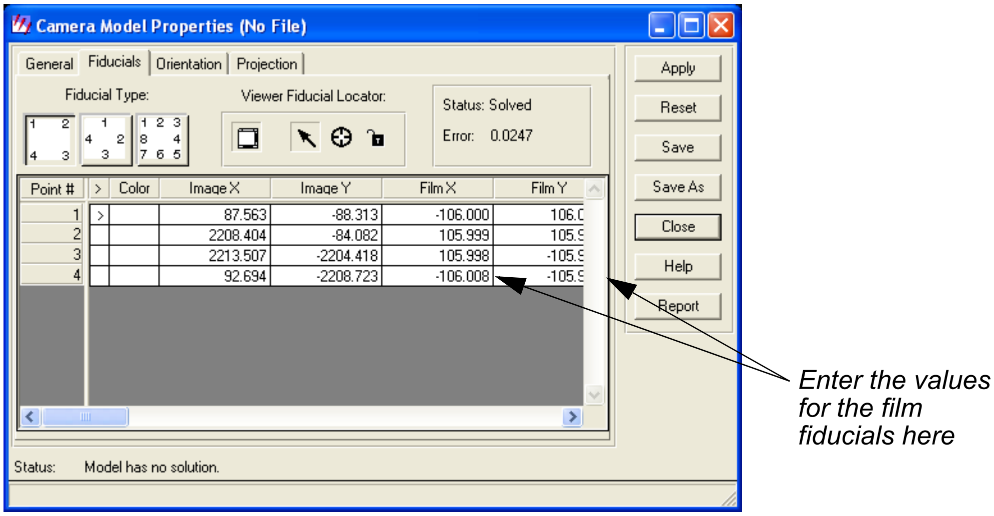
It is necessary to enter the **Film** coordinates into the Camera Model Properties dialog manually. The data provider can include this information in the camera calibration certificate.

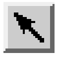
1. Being sure to match the point numbers with the proper coordinates, enter the **Film X** and **Film Y** coordinates from the following table:

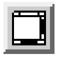
Table 6: Film X and Film Y Coordinates

Point #	Film X	Film Y
1	-106.000	106.000
2	105.999	105.994
3	105.998	-105.999
4	-106.008	-105.999

When the last **Film** coordinate has been entered in the Camera Model Properties dialog, the **Status** changes to **Solved** and the software calculates the **Error**. The presence of the **Error** value indicates that the interior orientation parameters have been solved.



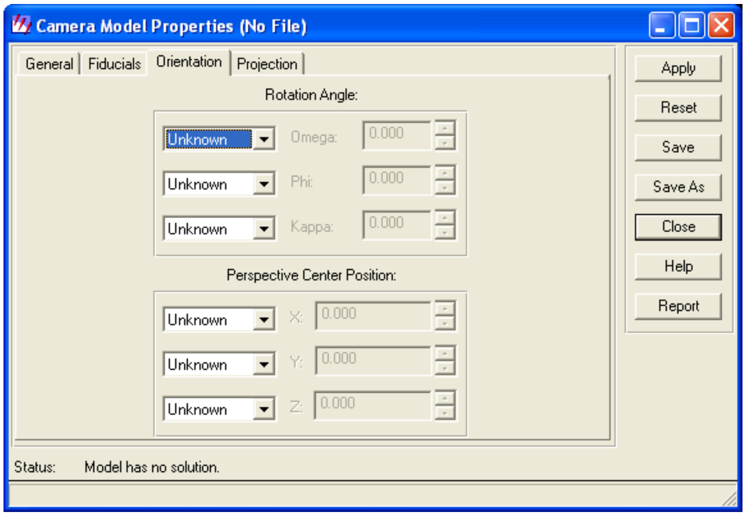
An error of less than **1.0000** is acceptable. An error of greater than **1.0000** indicates that the points were inaccurately measured or poorly identified. You can reposition the points using the Select Image Fiducial icon  to improve your results.

2. In the Camera Model Properties dialog under **Viewer Fiducial Locator**, click the Toggle icon  .

   The Chip Extraction Viewer (the second Viewer) closes.

3. Click the **Orientation** tab in the Camera Model Properties dialog.

   The Orientation options display.



If you have known parameters for the **Rotation Angle** and **Perspective Center Position** derived from another triangulation package, **Fixed**, or if you have estimated values, **Estimate**, you can enter them in the **Orientation** tab.

In this example, the orientation parameters are **Unknown**.

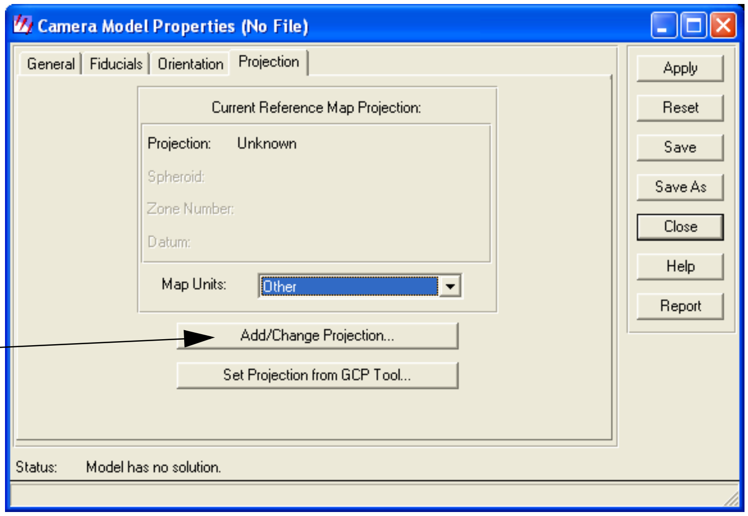
If **Account for Earth's curvature** is selected under the **General** tab, then the options on the **Orientation** tab are disabled (see **step 5.**).

Change Projection

1. Click the **Projection** tab in the Camera Model Properties dialog.

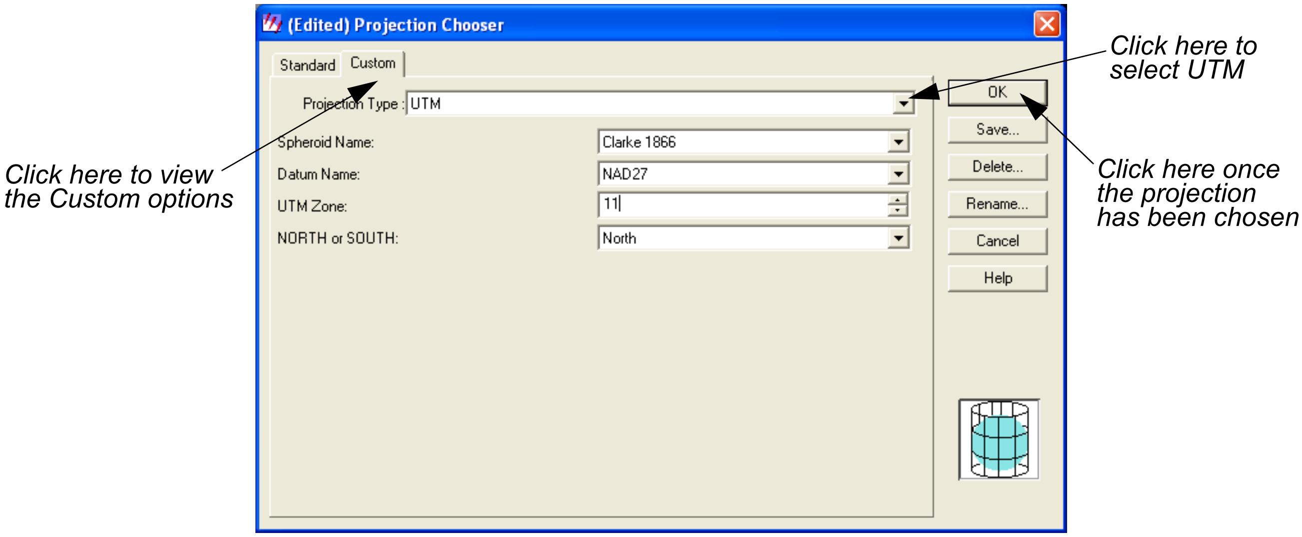
The Projection options display.

Click this button to change the projection



2. In the Projection options, click **Add/Change Projection**.

The Projection Chooser dialog opens.



3. In the Projection Chooser dialog, click the **Custom** tab.

4. Change the **Projection Type** to **UTM** using the dropdown list.

5. Change the **Spheroid Name** to **Clarke 1866** using the dropdown list.

6. Change the **Datum Name** to **NAD27** using the dropdown list.

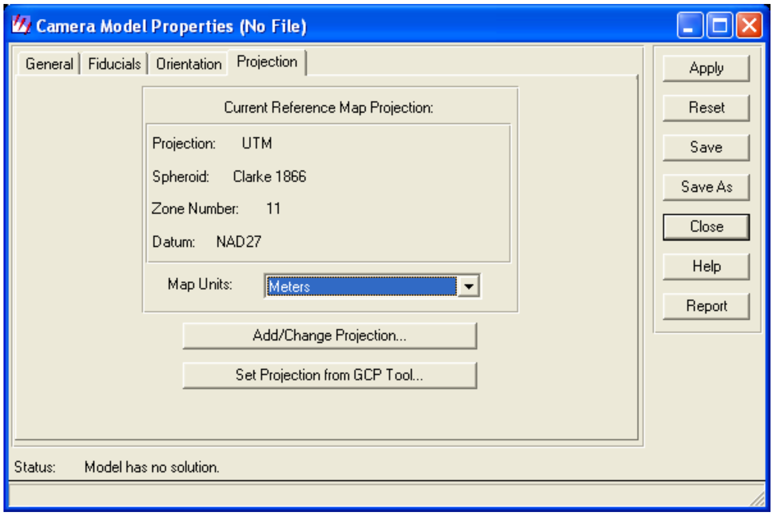
7. Change the **UTM Zone** to **11** by typing in the value or using the increment nudgers.

8. Confirm that the **NORTH or SOUTH** window displays **North**.

9. Click **OK** in the Projection Chooser dialog.

   The projection information you just entered displays under **Current Reference Map Projection** in the Camera Model Properties dialog.

10. In the Camera Model Properties dialog, click the dropdown list next to **Map Units** and select **Meters** (this activates the **Apply** button).



11. Click **Apply** and then **Save As** in the Camera Model Properties dialog.

The Geometric Model Name dialog opens.

Name the Geometric Model

1. In the Geometric Model Name dialog next to **File name**, enter the name **geomodel** in the directory of your choice, then press Enter on your keyboard.

The .gms file extension is added automatically.

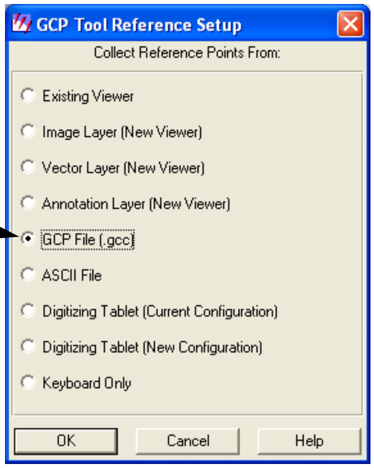
2. Click **OK** in the Geometric Model Name dialog.

Start the GCP Tool and compute RMS Error

1. In the Geo Correction Tools dialog, click the GCP Tool icon  .

The GCP Tool Reference Setup dialog opens.

Select the GCP File radio button



2. In the GCP Tool Reference Setup dialog, select **GCP File (.gcc)** under **Collect Reference Points From**, and then click **OK**.

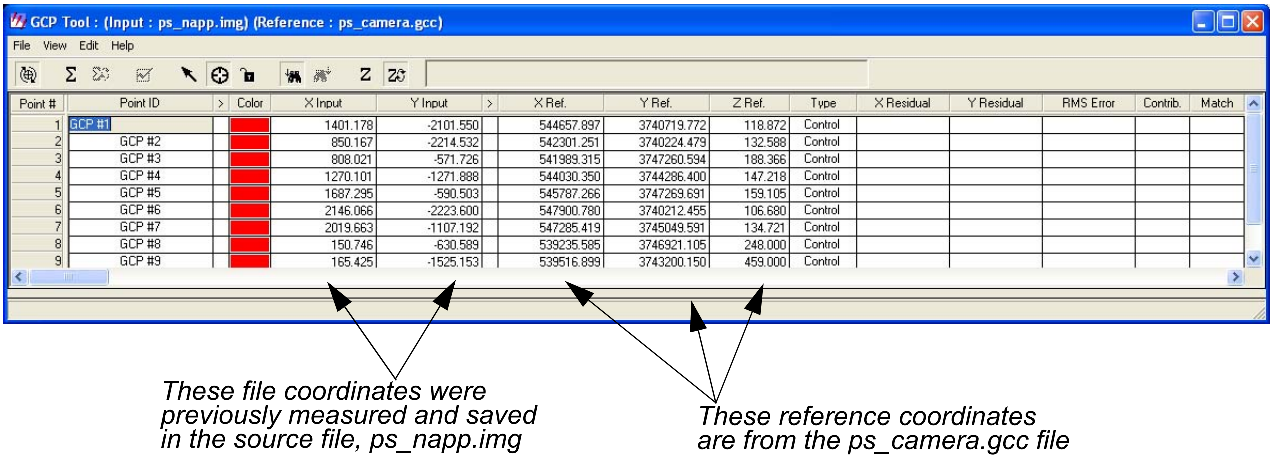
   The Reference GCC File dialog opens.

3. In the Reference GCC File dialog, select **ps_camera.gcc**.

   The reference points in this file were obtained from USGS 1:24,000 scale topographical maps using a digitizer.

4. Click **OK** in the Reference GCC File dialog.

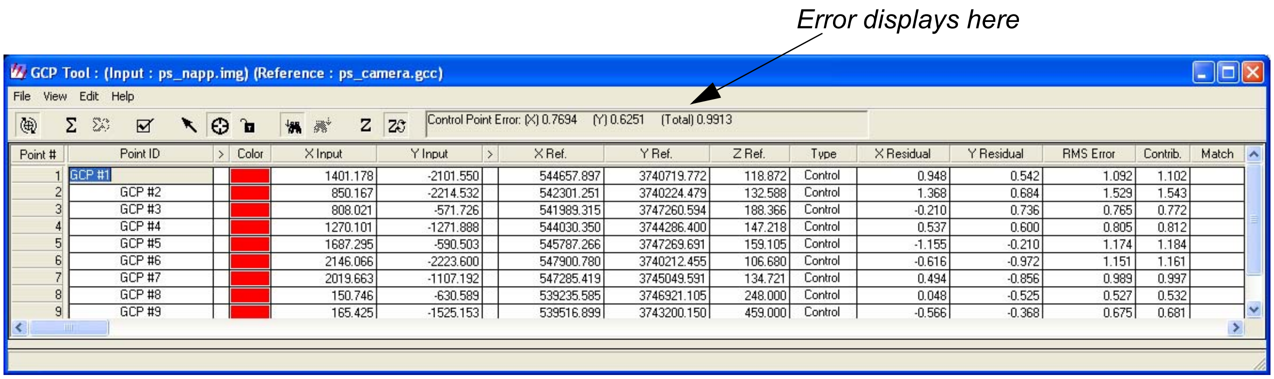
   A Chip Extraction Viewer (the second Viewer), a link box, and the GCP Tool open.



5. In the GCP Tool, click the Solve Geometric Model icon Σ .

NOTE: The orthorectification models do not have the option of Automatic Transform Calculation.

Clicking this icon solves the model and calculates the RMS error and residuals. The **Control Point Error** for the **X** and **Y** values displays beside the icons on the GCP Tool.



NOTE: The GCP Tool requires a minimum of three GCPs to run the model and at least six GCPs to make the model accurate and stable.

6. Click **Save** in the Camera Model Properties dialog.

Choose Your Path

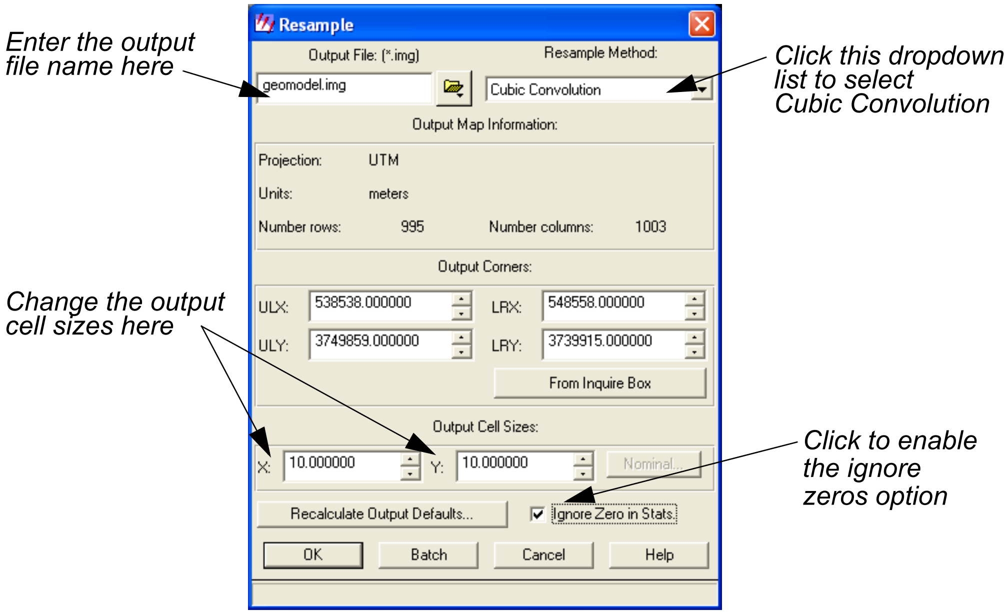
- If you would like to resample the camera image, proceed to **"Resample the Image"**.
- If you would like to calibrate the camera image, proceed to **"Calibrate the Image"**.

Resample the Image

Resampling requires an input file and a transformation matrix by which to create the new pixel grid.

1. In the Geo Correction Tools, click the Resample icon .

   The Resample dialog opens.



2. In the Resample dialog under **Output File**, enter **geomodel.img** in the directory of your choice.

3. Under **Resample Method**, click the dropdown list and select **Cubic Convolution**.

4. Under **Output Cell Sizes**, enter **10** for **X** and **10** for **Y**.

   NOTE: The default **Output Cell Sizes** *are based on the triangulation. The smaller the pixel size, the larger the output file size.*

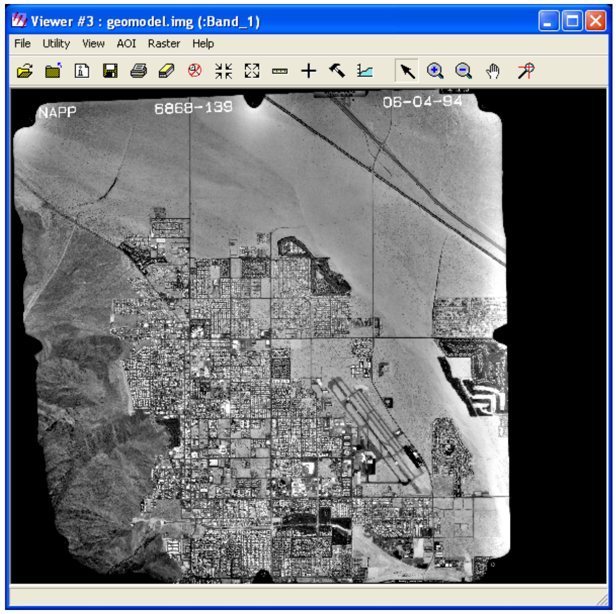
5. Click the **Ignore Zero in Stats.** checkbox to activate it.

6. Click **OK** in the Resample dialog.

   A Job Status dialog displays, indicating the progress of the function.

7. When the Job Status dialog indicates that the process is 100% complete, click **OK**.

8. Display **geomodel.img** in a Viewer to view the resampled orthoimage.

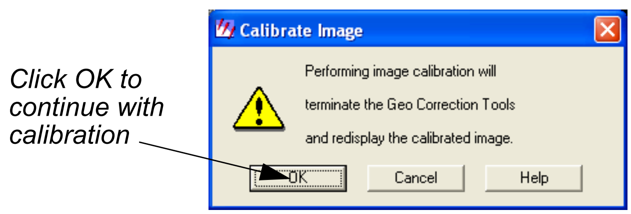


Calibrate the Image

To proceed with this portion of the tour guide, you must have completed the steps to rectify **ps_napp.img** in **"Rectify a Camera Image"**.

1. In the Geo Correction Tools dialog, click the Calibrate Image icon  .

A Calibrate Image warning box displays.



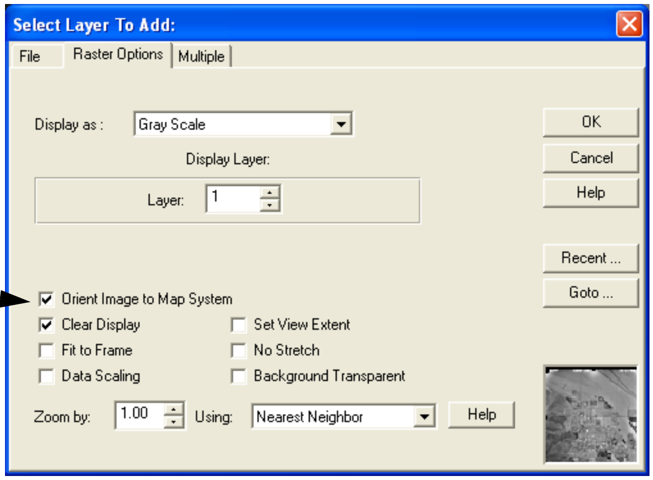
2. Click **OK** in the Calibrate Image warning box.

The Geo Correction Tool and all its associated dialogs close. The file **ps_napp.img** closes and then reopens in the Viewer, with the **Orient Image to Map System** option turned off. To apply the calibration to the image in the Viewer, you must redisplay the output image with the **Orient Image to Map System** option turned on.

3. Click the Open icon  and navigate to the location where you saved **ps_napp.img**.

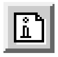
4. Select the file, then click the **Raster Options** tab.

Select the Orient Image to Map System checkbox to apply the calibration

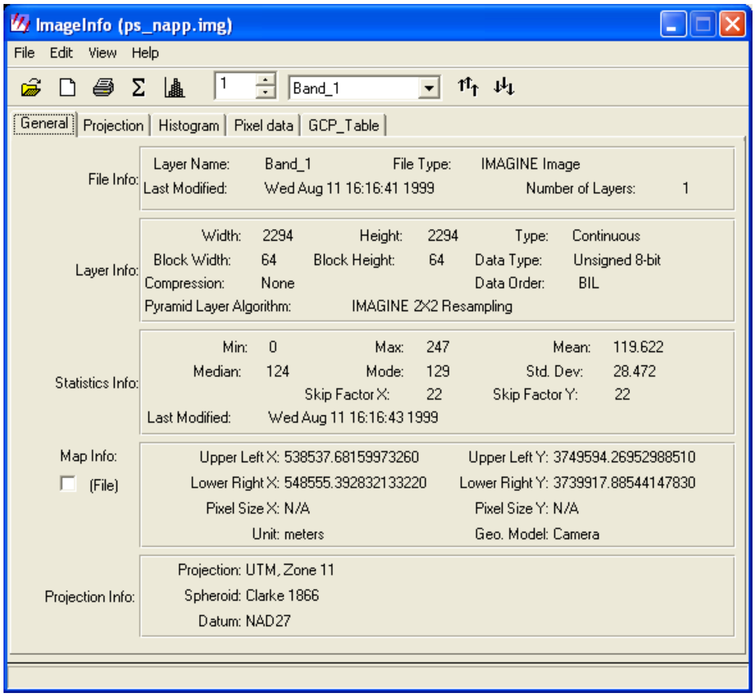


5. In the **Raster Options** tab, click to select the option **Orient Image to Map System**, then click **OK** in the Select Layer To Add dialog.

   *NOTE: Once calibrated, this image cannot be reused in the orthorectification process using the information/coordinates files provided. Calibration must be deleted (***Edit -> Delete Map Model*** in the ImageInfo dialog) for this file to be used again for this tour guide.*

6. In the Viewer, click the Info icon  to view the calibration information.

   The ImageInfo dialog opens, displaying the information for the calibrated image.



For a more in-depth discussion of the concepts behind rectification, see the chapter "Rectification" in the ERDAS Field Guide.

Terrain Surface Interpolation

Introduction

The Surfacing Tool enables you to create a three-dimensional surface from irregularly spaced points. Supported input data include:

- ASCII point files
- Arc point and line coverages
- ERDAS IMAGINE *.ovr layers
- existing raster images (IMG)

All input data sources must have X, Y, and Z values. Surface Interpolation calculates Z values at spatial locations where no Z samples exist in the input data source. The output is a continuous raster image that contains Z values calculated from the interpolation process.

The ERDAS IMAGINE Surface Tool uses a TIN interpolation method. At each point where there is a known value, that known value remains unchanged in the output surface. Where the value is not known, it is interpolated from the surrounding known values.

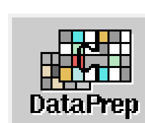
Two TIN interpolation methods are available in the Surface Tool: Linear and Nonlinear. The Linear interpolation method, which makes use of a first-order polynomial equation, results in the TIN triangles being defined as angular planes. The Nonlinear interpolation method, which uses a fifth-order polynomial, results in a smooth surface. In this case, the TIN triangle areas are not considered to be planes, but areas that have rubber sheet characteristics. The Linear interpolation method is quicker and the results more predictable. However, the Nonlinear interpolation method produces more continuous results from irregularly distributed data sets where the observed phenomena has a rolling, nonangular surface characteristic.

Approximate completion time for this tour guide is 15 minutes.

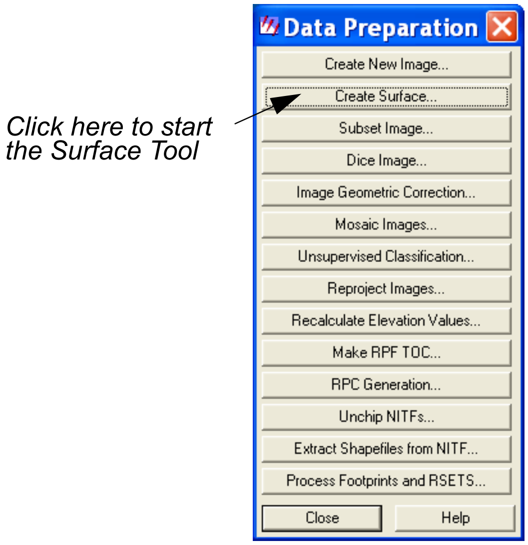
Create a Surface

ERDAS IMAGINE must be running and a Viewer open.

1. Click the DataPrep icon on the ERDAS IMAGINE icon panel.

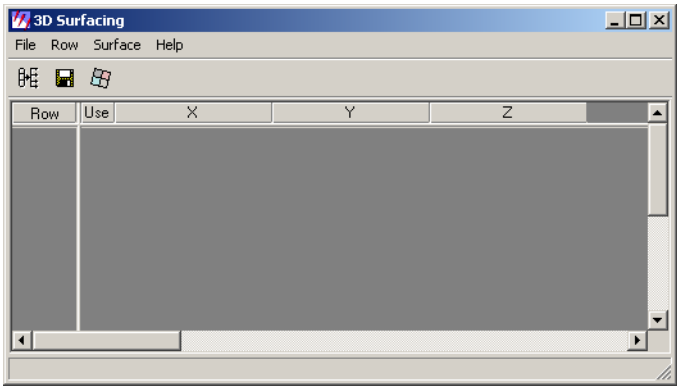


The **Data Preparation** menu opens.



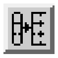
2. In the **Data Preparation** menu, click **Create Surface**.

The 3D Surfacing dialog opens.

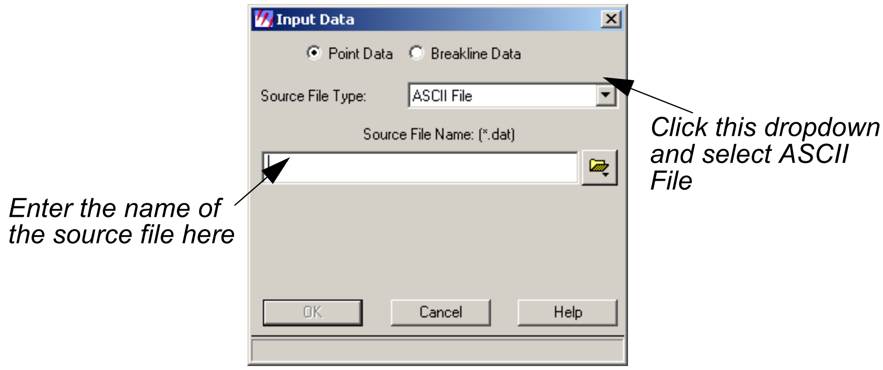


3. Click **Close** in the **Data Preparation** menu to clear it from the screen.

Import an ASCII File

1. In the 3D Surfacing dialog, click the Read New Data icon  .

The Input Data dialog opens.



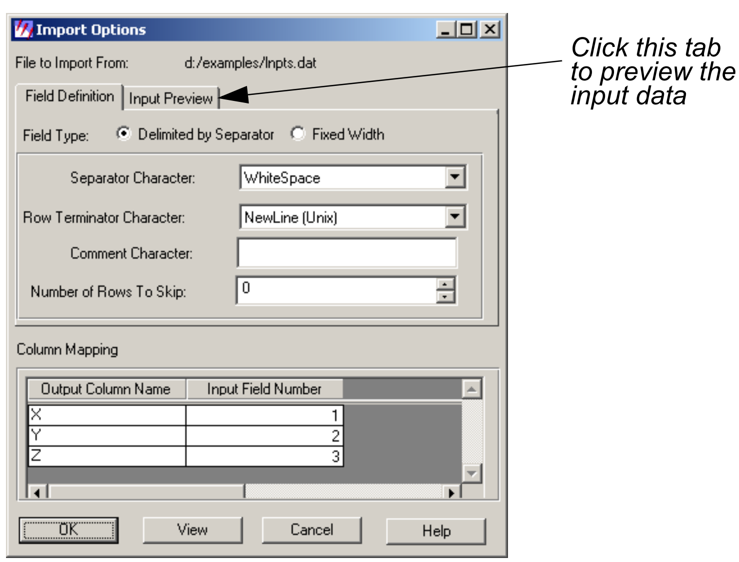
2. In the Read Points dialog, click the dropdown arrow next to **Source File Type** and select **ASCII File**.

3. Under **Source File Name**, enter **Inpts.dat**.

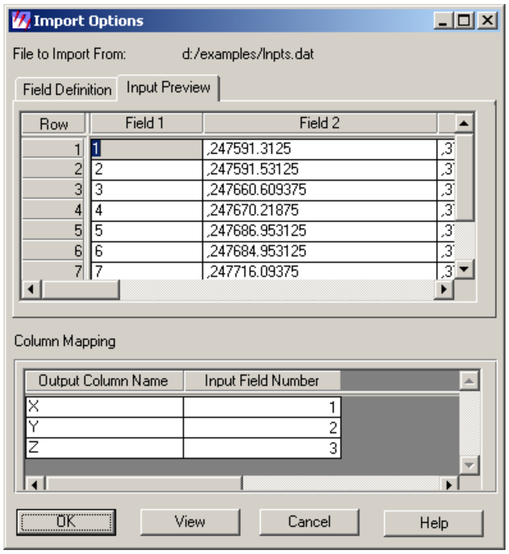
This file is located in the <ERDAS_Data_Home>/examples directory, where <ERDAS_Data_Home> represents the name of the directory where sample data is installed.

4. Click **OK** in the Read Points dialog.

   The Read Points dialog closes, and the Import Options dialog opens.



5. In the Import Options dialog, click the **Input Preview** tab to see how the ASCII file is imported and mapped under the present parameter settings.



From the **Input Preview** display, you can tell that the **Separator Character** is the comma and that **Field 1** should be ignored.

6. Click the **Field Definition** tab.

7. Click the dropdown list next to **Separator Character** and select **Comma**.

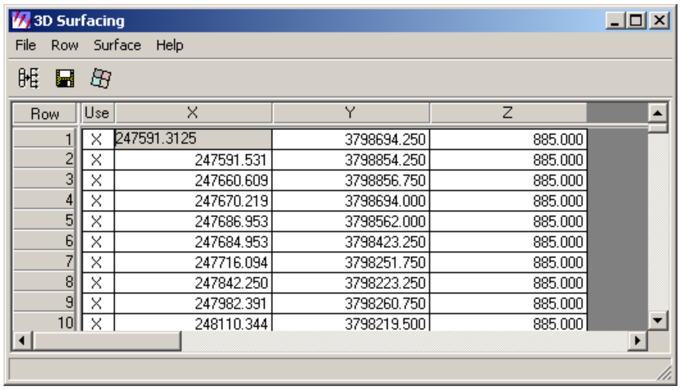
8. In the **Column Mapping** CellArray, alter the **Input Field Number** column values vertically from **1, 2, 3** to **2, 3, 4** in order to ignore the ID column of the input file.

9. Click **OK** in the Import Options dialog.

   A Job Status dialog opens, reporting the progress of the function.

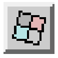
10. When the Job Status dialog shows that the process is 100% complete, click **OK (if necessary)**.

    The **X**, **Y**, and **Z** columns of the 3D Surfacing CellArray are now populated with 4,411 rows of X, Y, and Z coordinates.

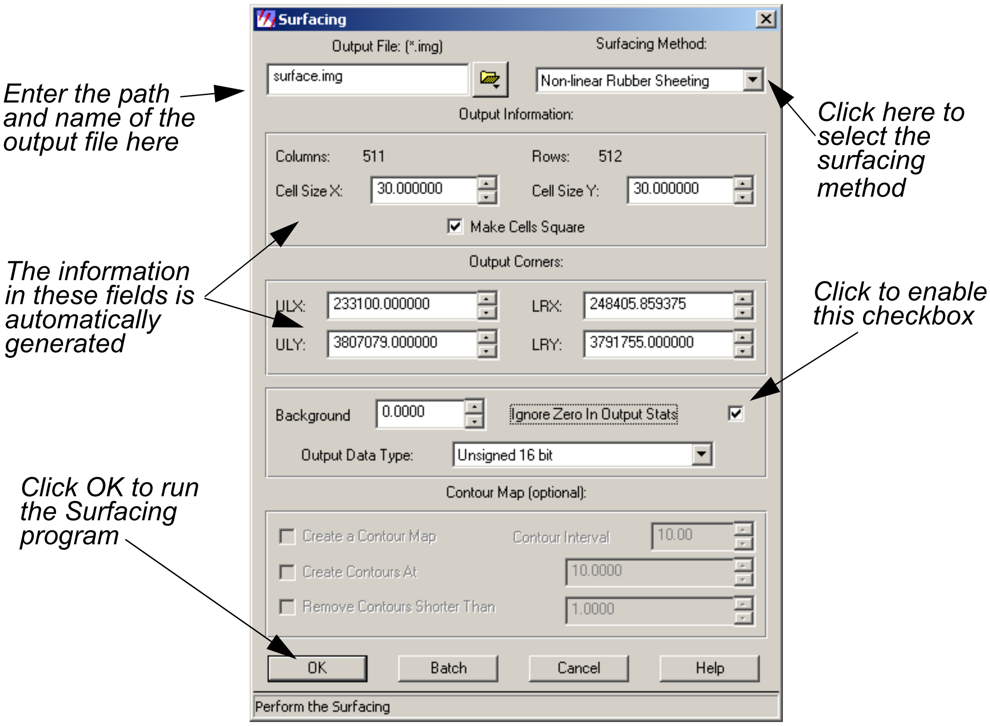


11. If you like, you can save these points as a **Point Coverage** (.arcinfo) or an **Annotation Layer** (.ovr) by selecting **File -> Save As** from the 3D Surfacing dialog menu bar.

Perform Surfacing

1. In the 3D Surfacing dialog, click the Perform Surfacing icon  .

   The Surfacing dialog opens. The extent and cell size defaults are filled in automatically, based on the source ASCII file.



The two options for a surfacing method are **Linear Rubber Sheeting** (1st Order Polynomial solution) and **Non-linear Rubber Sheeting** (5th Order Polynomial solution).

2. Under **Output File**, enter the name of the output file (for example, **surface.img**) in the directory of your choice.

3. Click the dropdown list next to **Surfacing Method** and select **Non-linear Rubber Sheeting**.

4. Click the **Ignore Zero In Output Stats** checkbox to enable it.

5. Click **OK** in the Surfacing dialog.

   A Job Status dialog displays, stating the progress of the function.

6. When the Job Status dialog reads that the function is 100% complete, click **OK** (if necessary).

Display the Surface

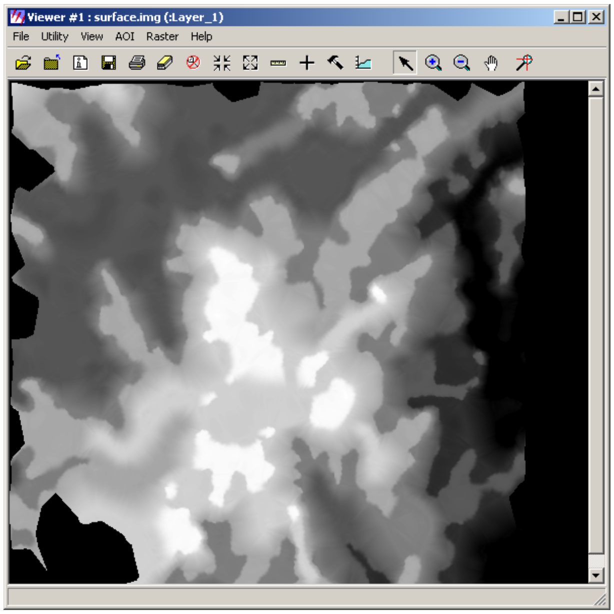
1. Click the Open icon in a Viewer.

   The Select Layer To Add dialog opens.

2. In the Select Layer To Add dialog under **Filename**, enter the name of the output file you created in **step 2.**, beginning with the directory path in which you saved it.

3. Click **OK** in the Select Layer To Add dialog.

   The output image displays in the Viewer for you to examine.



To edit portions of the resulting surface, use the raster editing techniques described in **Viewer & Geospatial Light Table**, **"Raster Editor"**.

MosaicPro

Introduction

This tour guide steps you through mosaicking two or more image files to produce one image file. The mosaicking process works with rectified and/or calibrated images. MosaicPro lets you draw and edit a new seam polygon in an embedded viewer. The seam polygon is applied to the image in which the first vertex is digitized, then the embedded viewer is updated and the input images are stitched along the seam polygon boundaries.

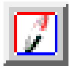
Mosaic Using Laguna Beach Images

In this section, you will mosaic Laguna beach images.

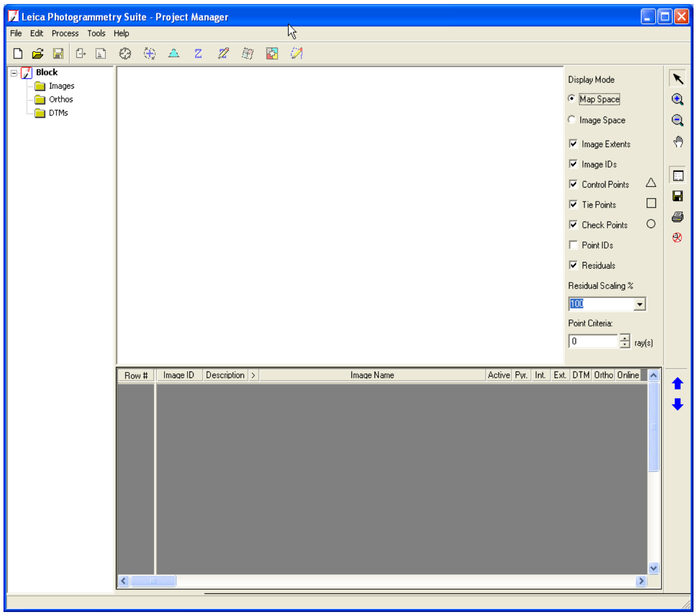
Starting MosaicPro

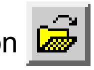
MosaicPro dialog is started from the LPS or the DataPrep menu, both on the ERDAS IMAGINE icon panel.

Starting MosaicPro From LPS

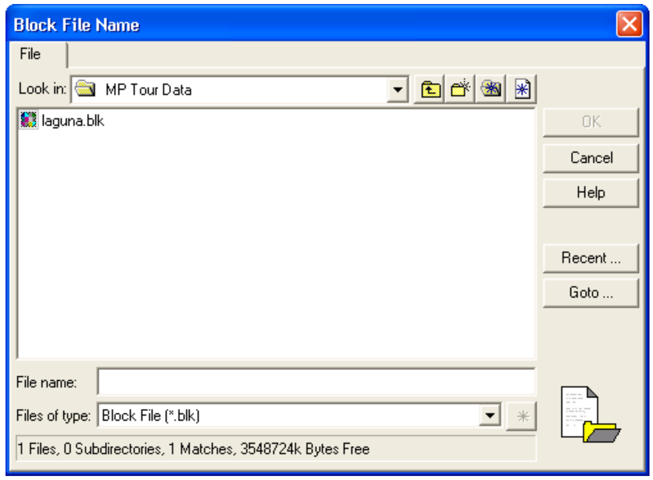
1. In the ERDAS IMAGINE icon panel, click the LPS icon  .

   The LPS Project Manager opens.



2. In the Project Manager, select **File -> Open** or click the Open icon  .

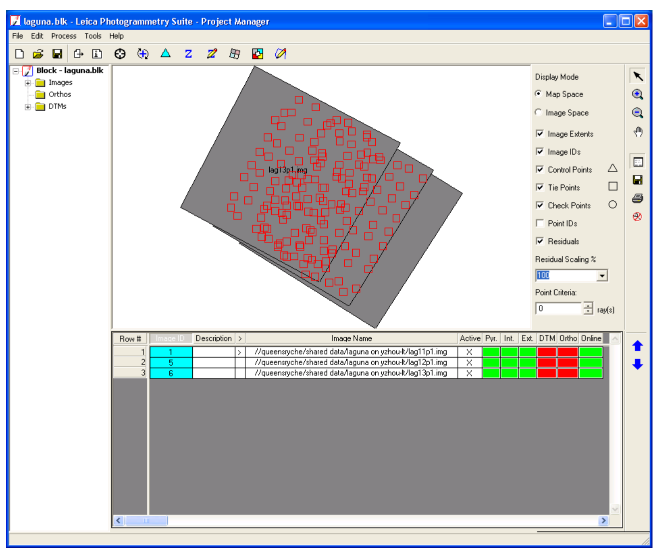
   The Block File Name dialog opens.



3. In the Block File Name dialog under **File name**, select **laguna.blk** from the list.

4. Click **OK** in the Block File Name dialog.

   The file laguna.blk displays in the LPS Project Manger.



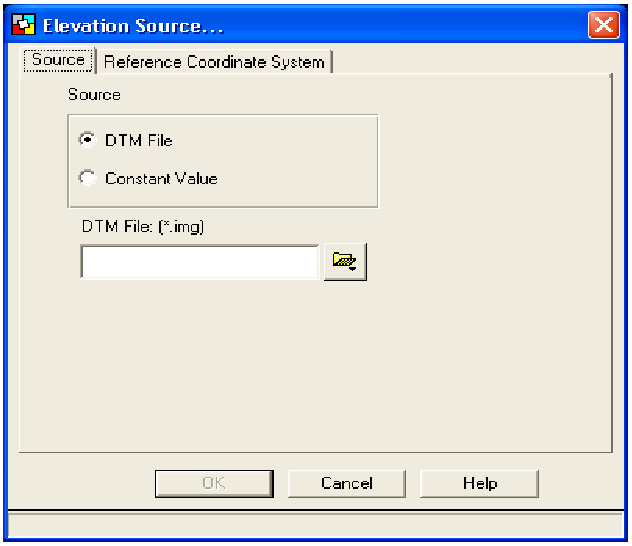
Adding and Displaying Images in MosaicPro

1. Click the Mosaic icon  .

   The Start Ortho Mosaicking dialog opens.

2. Select **MosaicPro** from the dropdown list and click **OK**.

   The MosaicPro Viewer and Elevation Source dialog opens.



3. In the Elevation Source dialog, click the **DTM File** button.

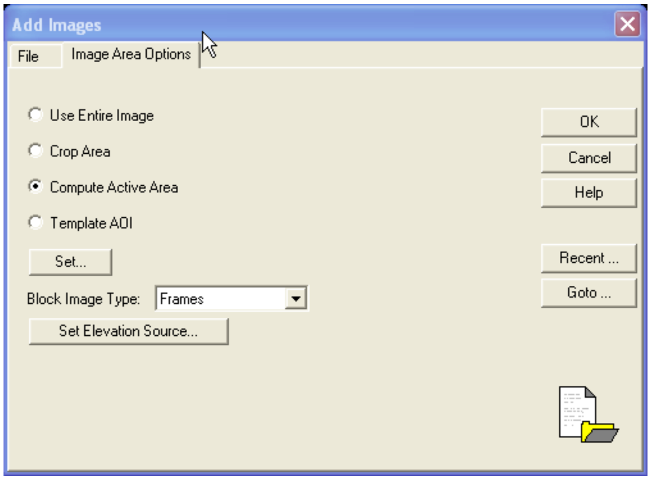
4. Click the Open icon  , and the DTM File dialog opens.

5. In the DTM File dialog under **Filename**, select **laguna_reference_dem.img** from the list.

6. Click **OK** in the DTM File dialog.

7. Click **OK** to dismiss the Elevation Source dialog.

   The Add Images dialog opens.

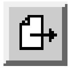


8. Click the **Compute Active Area** button.

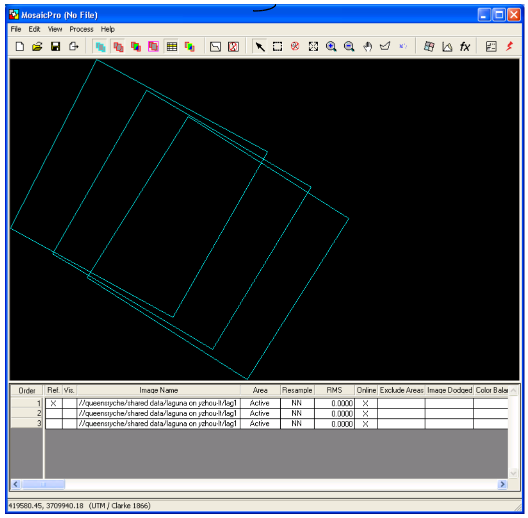
9. Click **OK** to close the Add Images dialog and add images in the **MosaicPro Viewer**.

Starting MosaicPro From the DataPrep menu

1. In the ERDAS IMAGINE icon panel, click the DataPrep  icon. Click Mosaic Images and select MosaicPro.

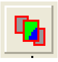
2. Click the Add Images  icon and select the **laguna_beach** images.

   The MosaicPro Viewer opens.

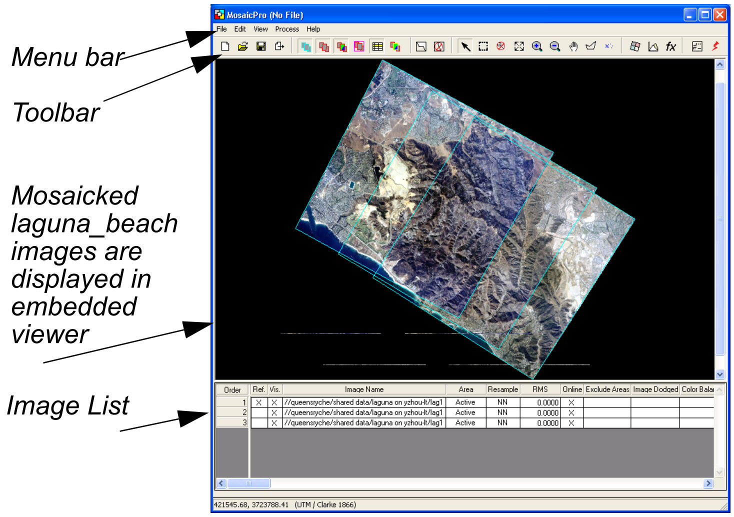


The data for **laguna_beach** images displays in the MosaicPro Image List CellArray.

If the Image List is not automatically displayed at the bottom of the MosaicPro viewer, go to **Edit -> Show Image Lists***, and select it.*

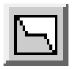
3. Click the **Vis** box in the image list cellarray for each of the three images, then select **View -> Show Rasters** in the viewer menu or click the **Display raster images** icon  .

The raster images display.

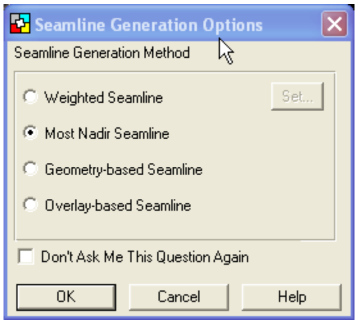


Drawing and Editing Seam Polygons

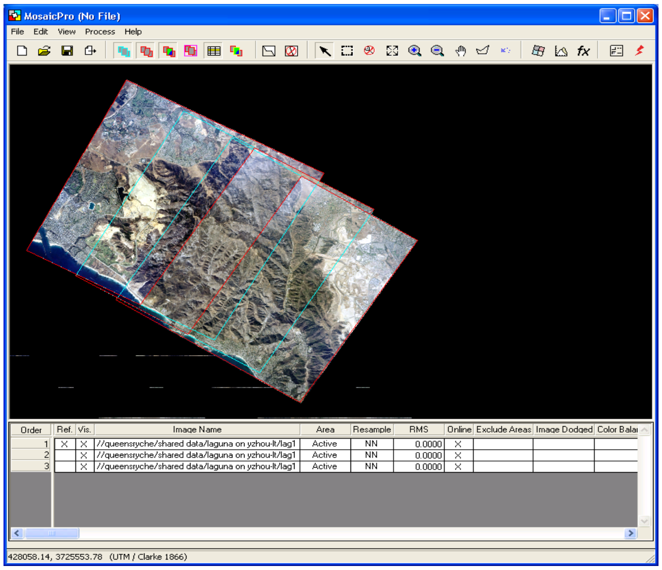
MosaicPro allows you to draw a seam polygon through images or a single polygon in an individual image.

1. In the viewer, click the Seamlines Generation Options  icon.

   The Seamline Generation Options dialog opens.



2. Select **Most Nadir Seamline** and click **OK** to accept this option.



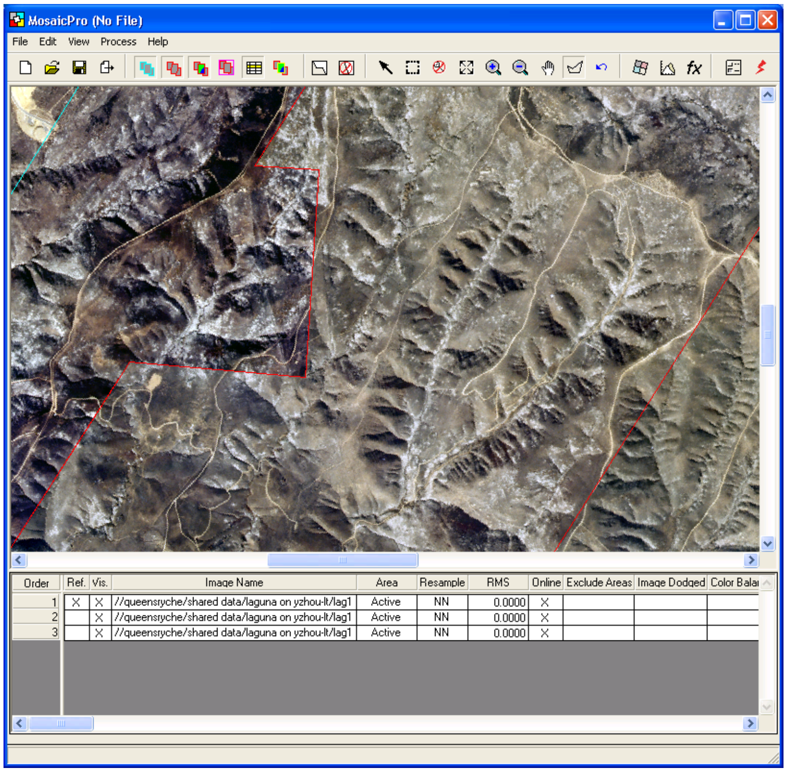
3. Use the Zoom In icon  to look closely at the seamline area you want to digitize.

4. Select the Create Polygon icon  on the viewer.

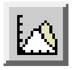
   Once in the viewer, the cursor becomes a cross hair.

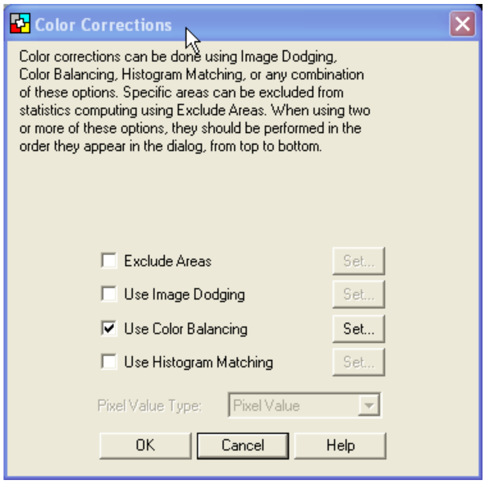
5. Draw and edit the **seam polygon**: place the cursor in the image to be included in the final mosaic, left click to start drawing the polygon, and the first side of the polygon appears. Move the cursor to the right and draw the polygon by left-clicking at each vertex. Double-click at the last vertex to close the polygon. The seamlines redraw so that the image containing your first left click is enlarged (seamlines drawn) by all polygon sides in that image.

6. The edited seam polygon displays.



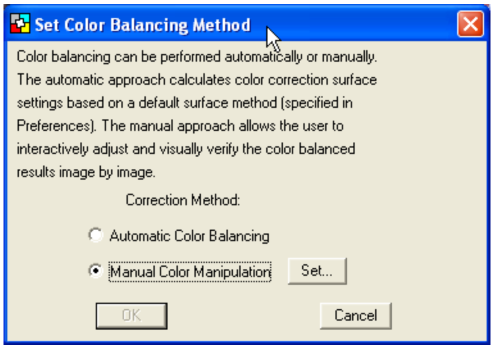
Correcting Color

1. Select **Edit -> Color Corrections** from the viewer menu or click the Color Corrections icon  and the Color Corrections dialog opens.



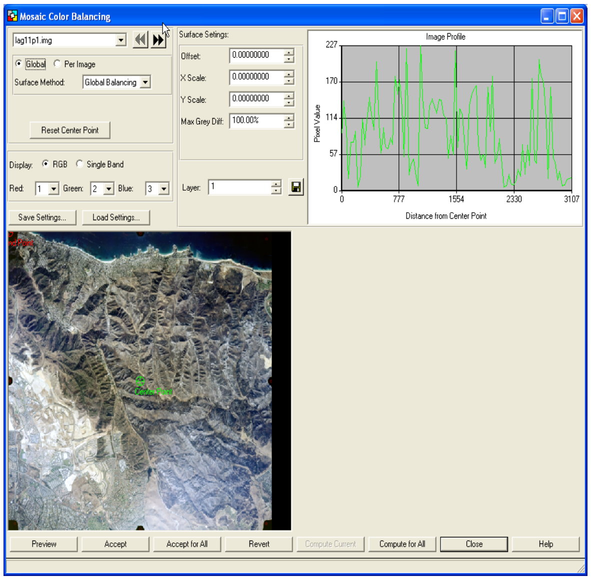
2. Select **Use Color Balancing** and click **Set**.

   The Set Color Balancing Method dialog opens.



3. Select **Manual Color Manipulation** and click **Set**.

   The progress meter displays and then the Mosaic Color Balancing dialog opens.



4. Click **Reset Center Point.**

5. Select **Global** and **Global Balancing** from the **Color Balancing** dialog.

6. Click **Accept** and then **Preview**. Notice that color correction has reduced the haze in the image.

7. Click **Close** to accept these changes and close the Mosaic Color Balancing dialog.

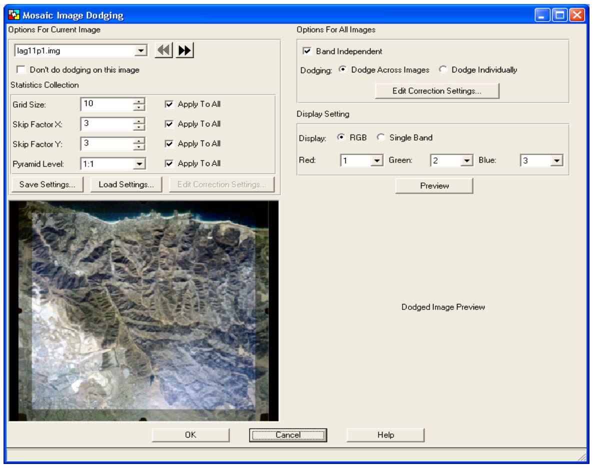
8. Click **OK** to close the Set Color Balancing Method dialog.

Image Dodging

In this section, you use the Image Dodging option to correct light imbalances in an image.

1. Choose **Use Image Dodging** in the Color Corrections dialog, and click the **Set** button.

   The Image Dodging dialog opens.



2. In the Image Dodging dialog, make sure under **Display Setting**, the band choices are **Red-1**, **Green-2**, and **Blue-3**.

   Notice the bright spot you need to correct.

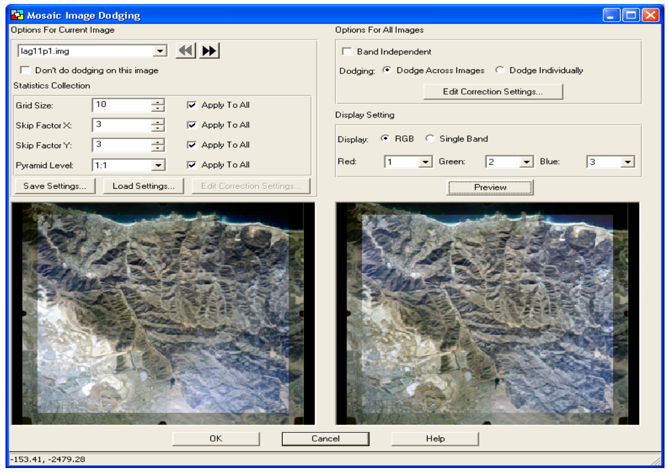
3. Look under **Statistics Collection** at **Grid Size**, **Skip Factor X**, and **Skip Factor Y**. You can change these numbers to suit your purposes, but for this exercise leave them at the defaults of **10**, **3**, and **3**.

4. Notice the Pyramid Level setting. This option allows you to accelerate the image dodging process by creating an image layer that is reduced by the power of 4 (if you choose 4:1). When you select more than one pyramid level, the **Skip Factor** options are not applicable. For this exercise, leave the setting at 1:1.

5. Look under **Options For All Images**, make sure **Band Independent** is **not** selected (**unchecked**). This will yield **Band Dependent** results.

6. Click **Preview** to view the image after applying Image Dodging.

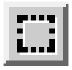
   The image appears in the Dodge Image Preview section of the dialog.



7. Click **OK** to accept the dodged image, and click **Yes** in the Attention dialog. Wait for the statistics to compute.

8. Click **OK** to close Color Corrections dialog.

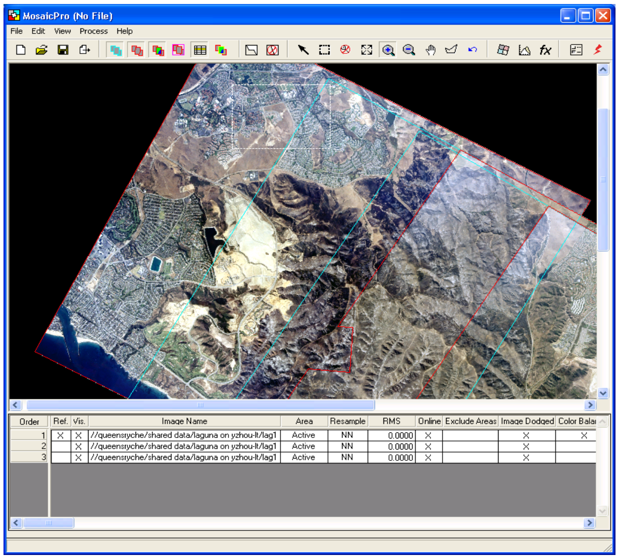
Previewing the Mosaic

1. Select the mosaic preview icon .

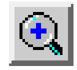
2. Click and drag to select the area to preview.

3. Select **Process -> Preview Mosaic for window**.

   The preview window is displayed in the image.

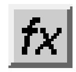


4. Click **OK** when the Job State meter reaches 100%.

5. Use the Zoom In icon  to see the area previewed.

6. Select **Process -> Delete the Preview Mosaic Window** to delete the Preview window.

Setting Seamline Functions

1. Click the Function  icon in the viewer.

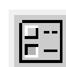
2. Click **No Smoothing** for the Smoothing Option.

3. Click **Feathering** for the Feathering Option.

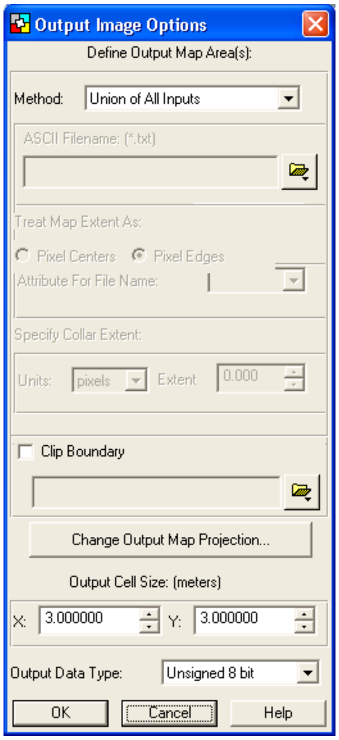
4. Enter 5 in the **Distance** field.

5. Click **OK** to accept the changes and close the **Set Seamline Function** dialog.

Defining the Output Images

1. Click the **Output Image**  icon in the viewer.

   The **Output Image Options** dialog opens.



2. In the Output Image Options dialog under **Define Output Map Area(s)**, make sure that Union of all Inputs is selected.

3. Click **OK** to close the Output Image Options dialog.

Running the Mosaic

1. In the viewer, select **Process -> Run Mosaic**.

2. In the Run Mosaic dialog under **Output File Name**, enter **tour_laguna.img** in the directory of your choice, then press **Enter**. Wait for the Mosaic Job State meter to reach 100%.

3. Click **OK** to close the Mosaic process meter dialog.

Displaying the Mosaic

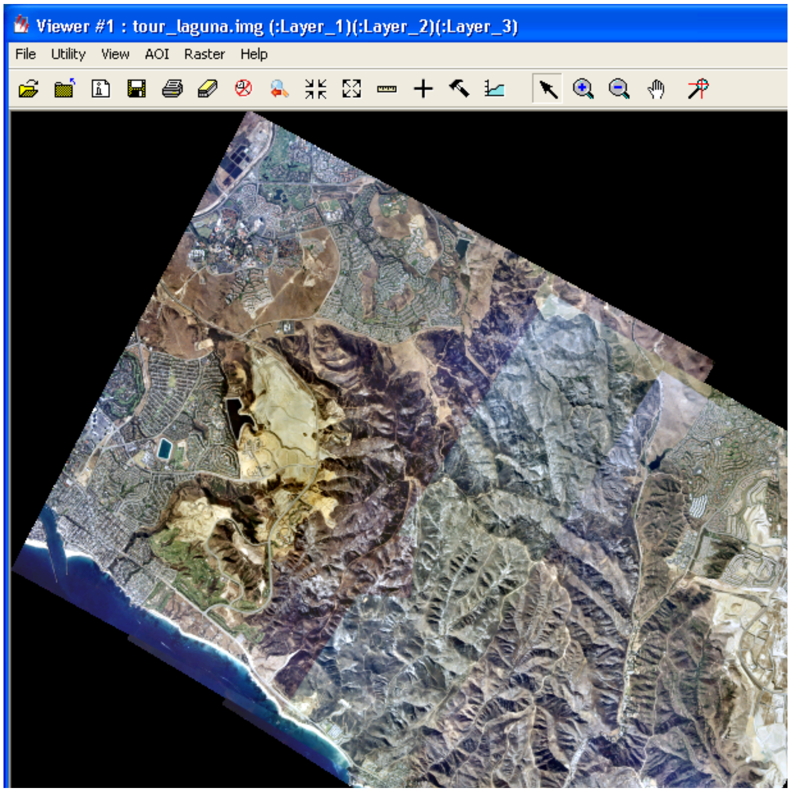
1. Open a viewer in the ERDAS IMAGINE icon panel.

2. Click the open icon  in the new viewer.

3. In the Select Layer to Add dialog under **Filename**, select **tour_laguna.img** from the directory in which you saved it.

4. In the same dialog, click the **Raster Options** tab and click **Fit To Frame.**

5. Click **OK** to display the mosaicked image: **tour_laguna**.



Viewshed Analysis

Introduction

One of the many tasks you can perform using IMAGINE Advantage is Viewshed Analysis. This tour guide describes how to use this analysis tool.

Viewshed Analysis allows you to position an observer on a DEM in a Viewer and determine the visible areas within the terrain. You can adjust the observer’s height either above ground level or above sea level and set the visible range.

This tool is useful for planning the location and height of towers used for observation or communications. It might also be used to determine areas that lie within poor reception of standard broadcast towers and are thus potential cable markets.

In this tour guide, you can learn how to:

- start an Image Drape viewer
- start the Viewshed tool
- work with multiple observers
- query Viewshed data and layers

Approximate completion time for this tour guide is 15 minutes.

Create a Viewshed

In this exercise, you create a viewshed, and analyze the terrain within it.

ERDAS IMAGINE must be running with a Viewer open.

1. Click the Open icon in the Viewer (or select **File -> Open -> Raster Layer**).
2. In the Select Layer To Add dialog, navigate to the <ERDAS_Data_Home>/examples directory.
3. Select the file **eldodem.img**, then click the **Raster Options** tab.
4. In the **Raster Options** tab, make sure that the **Fit to Frame** checkbox is active.
5. Click **OK** in the Select Layer To Add dialog.

Add the Raster Image

1. Click the Open icon again, and navigate to the <ERDAS_Data_Home>/examples directory.

2. Select the file **eldoatm.img**, then click the **Raster Options** tab.

3. In the **Raster Options** tab, make sure that the **Clear Display** checkbox is not active.

4. Click **OK** in the Select Layer to Add dialog.

   Both files are displayed in the Viewer.

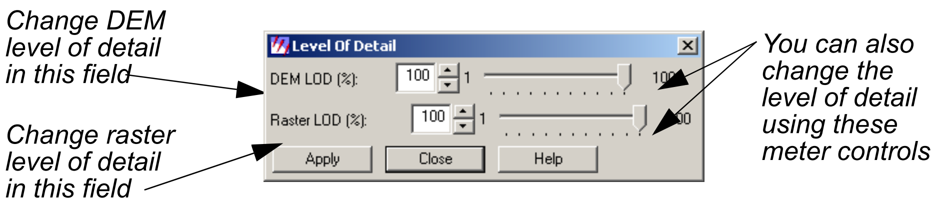
Start Image Drape Viewer and Set Level of Detail

1. From the menu bar of the Viewer displaying **eldodem.img**, select **Utility -> Image Drape**.

   The Image Drape Viewer opens displaying **eldodem.img**, which supplies terrain relief, and **eldoatm.img**, which supplies the color. Position the Image Drape Viewer so that it does not cover the first Viewer you opened. Now, you can set the level of detail.

2. Select **View -> LOD Control** from the Image Drape viewer menu bar.

   The Level Of Detail dialog opens.

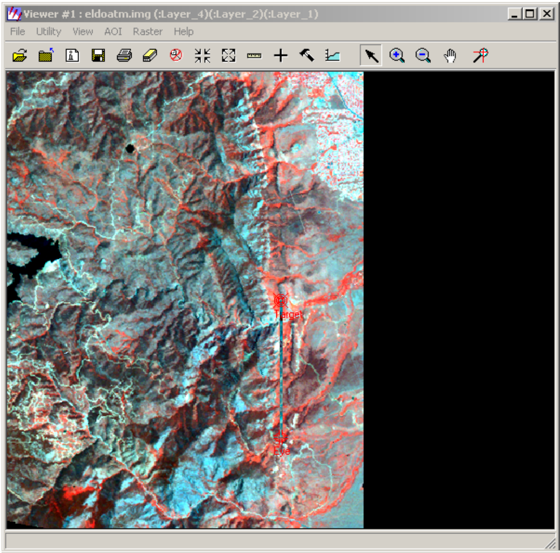


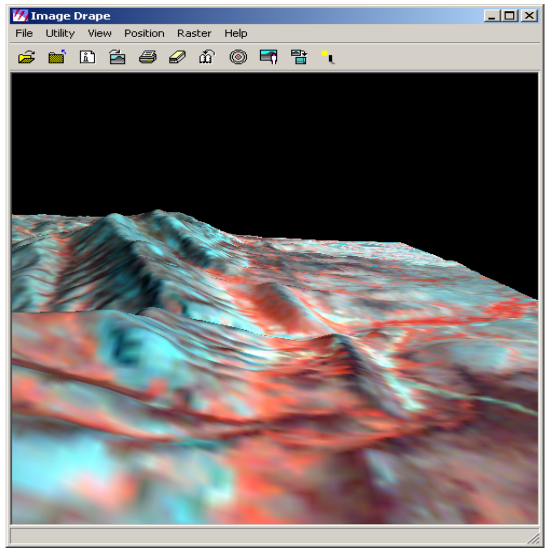
3. In the field next to **DEM LOD (%)**, enter **100**, and press Enter on your keyboard.

4. Click **Apply** to increase the level of detail in the Image Drape viewer.

5. Click **Close** to dismiss the Level Of Detail dialog.

   Your two Viewers now look like the following:





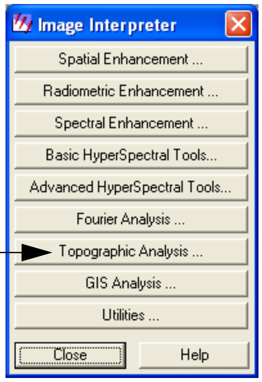
Start the Viewshed Analysis Tool

1. Click the Interpreter icon 

on the ERDAS IMAGINE icon bar.

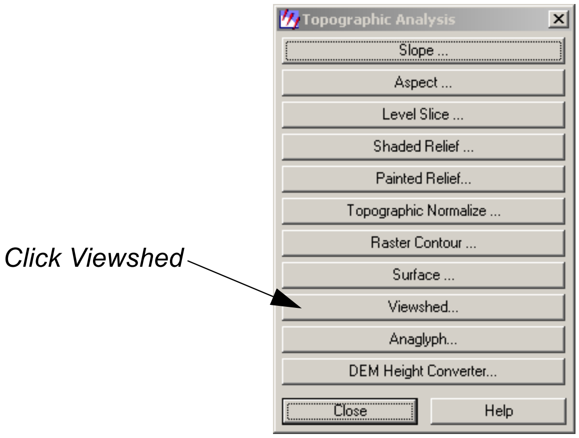
The **Image Interpreter** menu opens.

Select Topographic Analysis



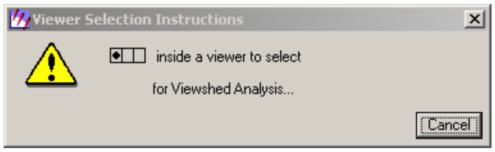
2. From the **Image Interpreter** menu, select **Topographic Analysis**.

The **Topographic Analysis** menu opens.



3. From the **Topographic Analysis** menu, select **Viewshed**.

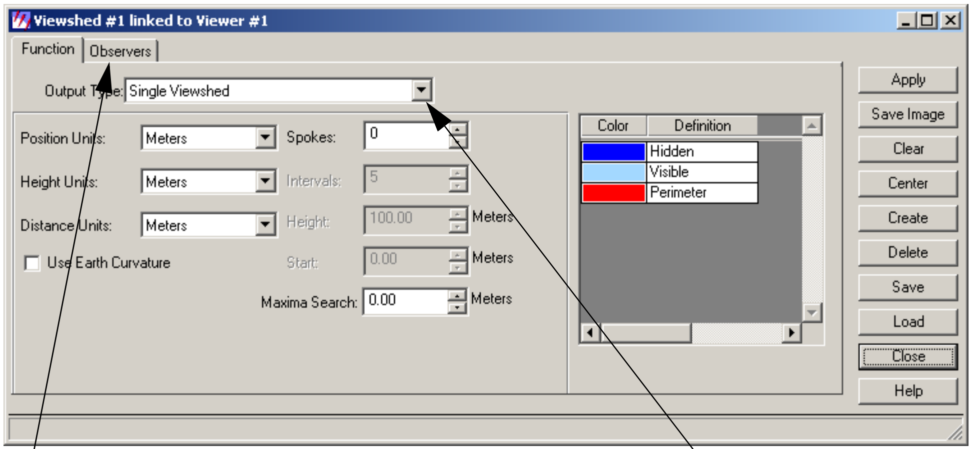
   A Viewer Selection Instructions dialog opens.



4. Click in the Viewer containing **eldodem.img** and **eldoatm.img**.

   The Viewshed dialog opens.

5. At this time, click **Close** on both the **Image Interpreter** menu and the **Topographic Analysis** menu to remove them from your display.



Click the Observers tab to add an observer

Select Multiple Viewsheds

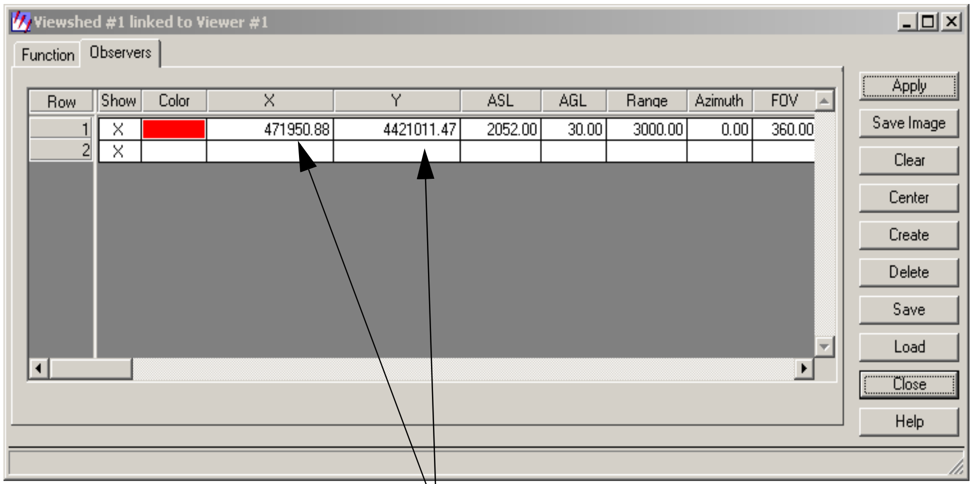
An observer marker is automatically placed in the center of the Viewer containing **eldodem.img**.

6. In the **Function** tab of the Viewshed dialog, click the dropdown list next to **Output Type** to select **Multiple Viewsheds**.

Add First Observer

1. Click the **Observers** tab in the Viewshed dialog.

   The **Observers** tab of the CellArray displays.



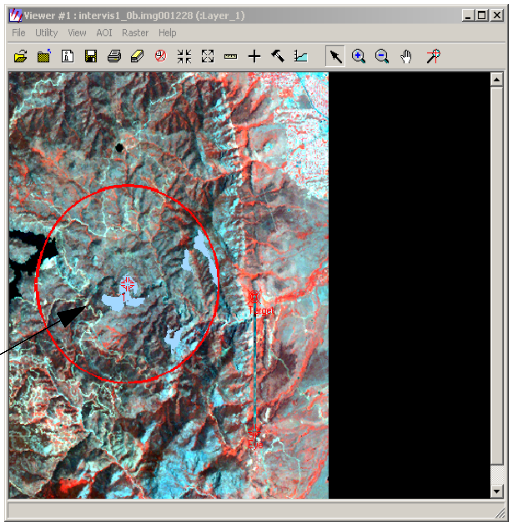
Specify the observer's position in these columns

2. Click in the cell of the **X** column to enter **471950.88**, then press Enter on your keyboard.

3. Click in the cell of the **Y** column to enter **4421011.47**, then press Enter on your keyboard.

4. Click **Apply** in the Viewshed dialog.

   The viewshed layer is generated and displays in the Viewer.

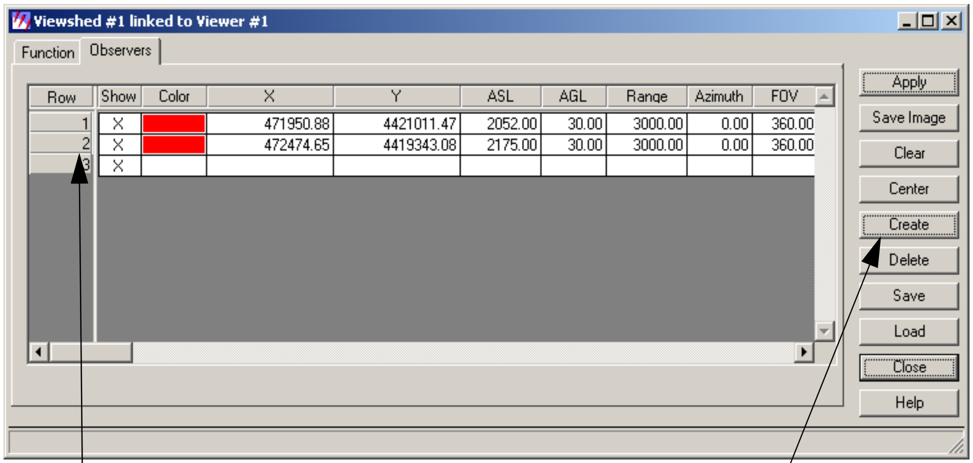


The area of the viewshed is marked by a circle

Add Another Observer

1. Click **Create** in the Viewshed dialog.

   A new observer is added to the CellArray.



The second observer is added to row 2

Click create

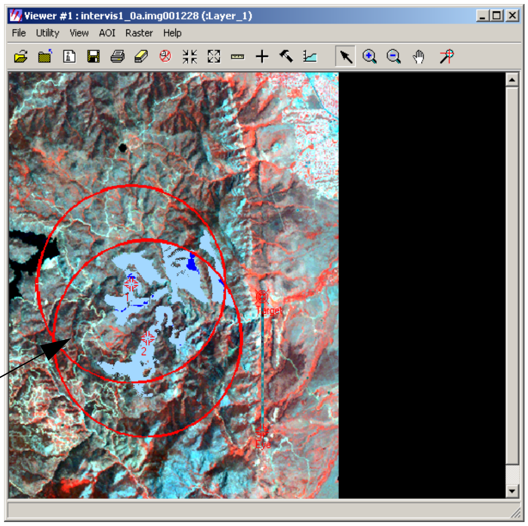
2. Click in the cell of the second observer's **X** column to enter **472474.65**, then press Enter on your keyboard.

3. Click in the cell of the second observer's **Y** column to enter **4419343.08**, then press Enter on your keyboard.

4. Click **Apply** in the Viewshed dialog.

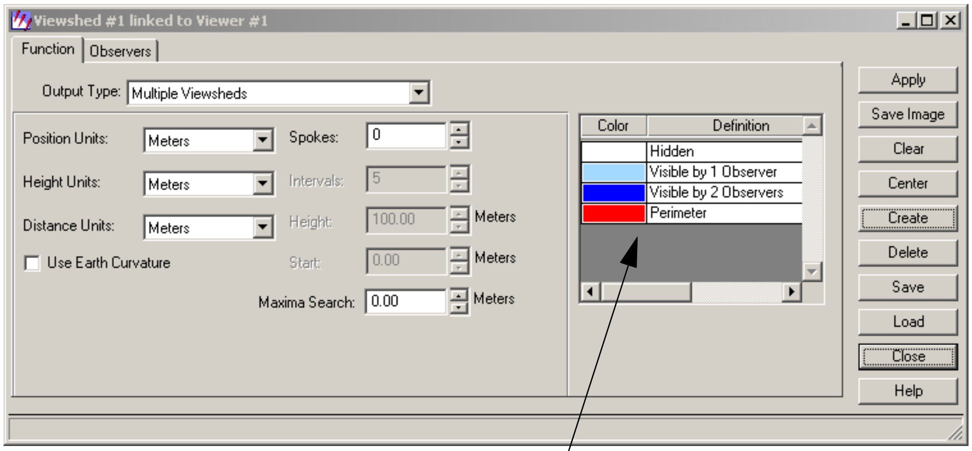
   The second viewshed layer is generated and displays in the Viewer.

Portions of the two viewsheds intersect, evidenced by the overlap of the red circles



5. Click the **Function** tab in Viewshed dialog to view the legend.

   The **Function** tab opens, displaying the legend of the viewshed.

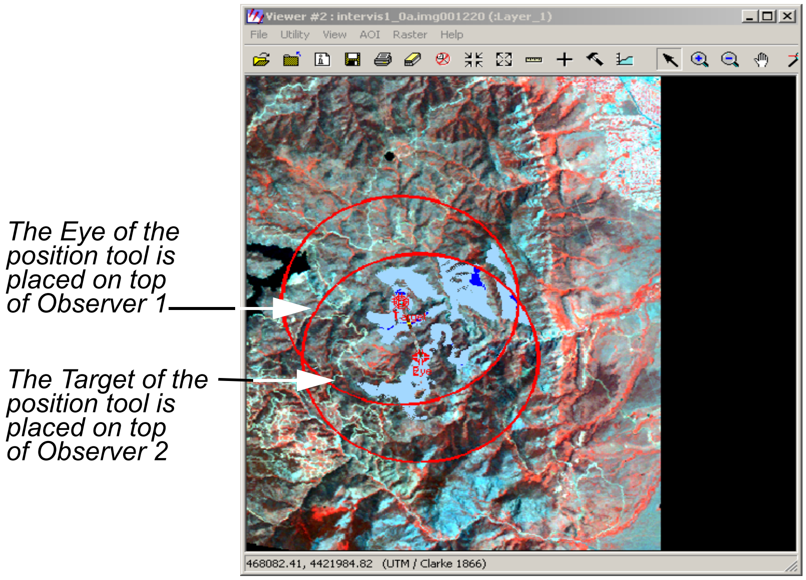


The legend displays here, in the Function tab

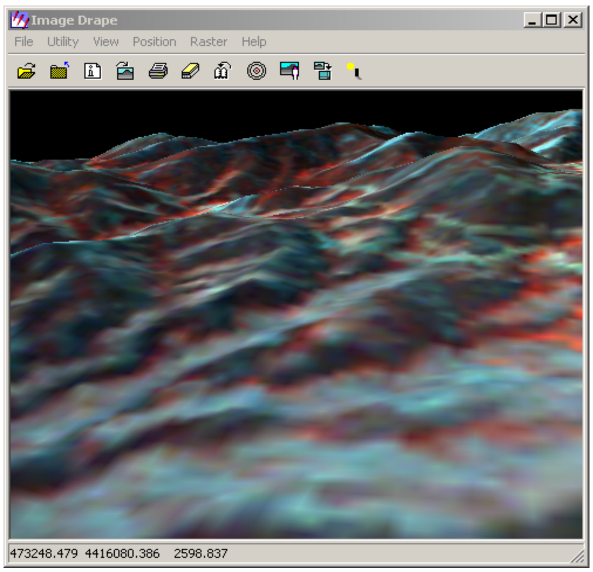
There are two basic kinds of output. The Viewshed outputs provide a binary analysis of visibility within the specified range. In other words, the image is color-coded to show only visible or hidden areas. The Height outputs provide a color-coded map of the invisible areas indicating the amount of change in observer height required to see a given zone.

Link the Viewers and Set Eye and Target Positions

1. Using your mouse, move the **Eye** of the Positioning tool on top of **Observer 1**.
2. Move the **Target** on top of **Observer 2** in the Viewer.



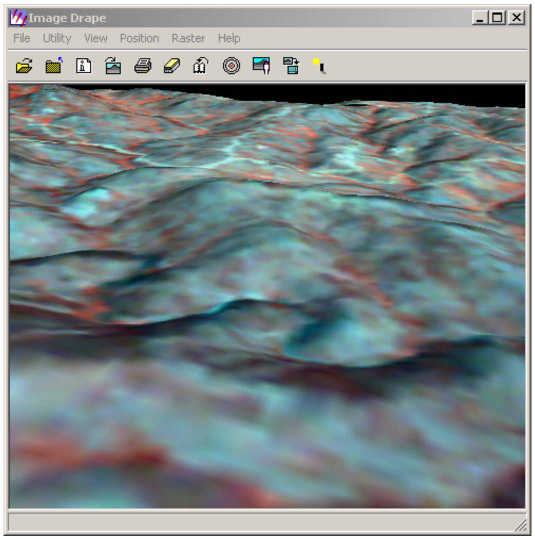
As you move the Positioning tool, the 3D image in the Image Drape viewer is updated. **Observer 1** is now looking at the location of **Observer 2**. The 3D image is positioned so that the target is centered in the Image Drape viewer.



3. Switch the **Eye** and **Target** of the Positioning tool in the Viewer.

   Observer 2 is now looking at the location of **Observer 1**.

   Again, the 3D image rotates to match the **Eye** and **Target** positions of the Viewer.



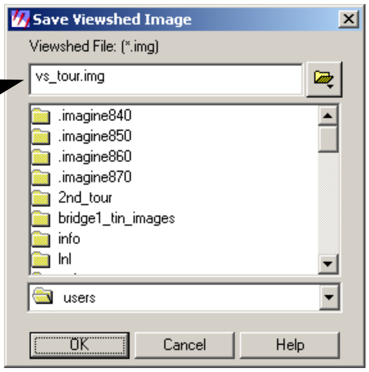
Save the Viewshed

What can we do with a saved viewshed? For example, the saved viewshed can be used to create a map composition.

1. In the Viewshed dialog, click **Save Image**.

   The Save Viewshed Image dialog opens.

Type the name of the viewshed image here in the directory of your choice



2. In a directory where you have write permission, type **vs_tour.img** in the **Viewshed File** window.
3. Click **OK** to dismiss the Save Viewshed Image dialog.

   A Viewshed Analysis progress meter opens while the image is saved.
4. Click **Close** to dismiss the Viewshed dialog.

Query Viewshed Data

In this section, use the Raster Attribute Editor to query the viewshed layer in the Viewer.

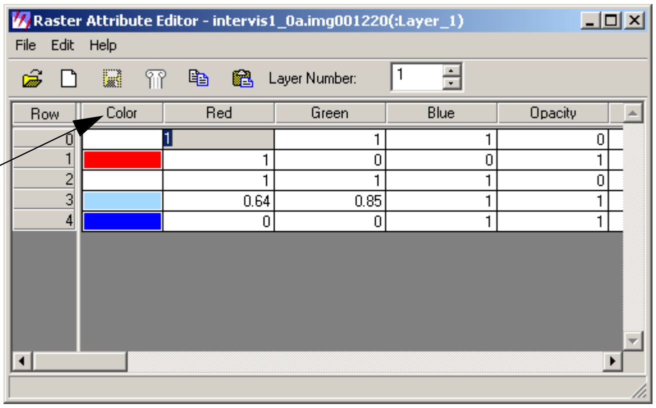
Create Class Names for Viewshed Regions

1. Open **vs_tour.img** in a viewer. This is the viewshed image that you saved in **Save the Viewshed** on page 108.

2. Select **Raster -> Attributes** from the Viewer menu bar.

   The Raster Attribute Editor opens.

Add a column for class names



3. Select **Edit -> Add Class Names** from the Raster Attribute Editor menu bar.

   A new column is added to the front of the Raster Attributes CellArray.

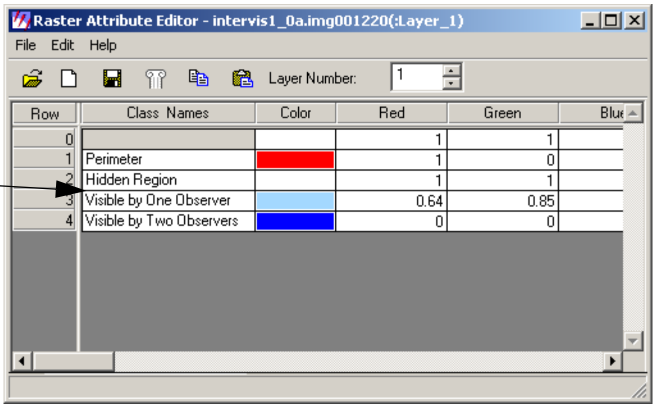
4. In **Row 1** of the **Class Names** column, enter **Perimeter**, and press Enter on your keyboard.

5. In **Row 2**, enter **Hidden Region**, and press Enter on your keyboard.

6. In **Row 3**, enter **Visible by One Observer**, and press Enter on your keyboard.

7. In **Row 4**, enter **Visible by Two Observers**, and press Enter on your keyboard.

Class Names identify each of the areas in the viewshed

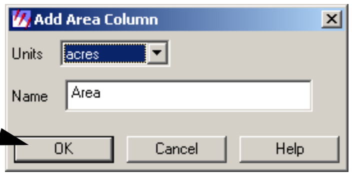


Add Area Column to the CellArray

1. Now select **Edit -> Add Area Column** from the Raster Attribute Editor menu bar.

   The Add Area Column dialog opens.

Click OK to accept hectares



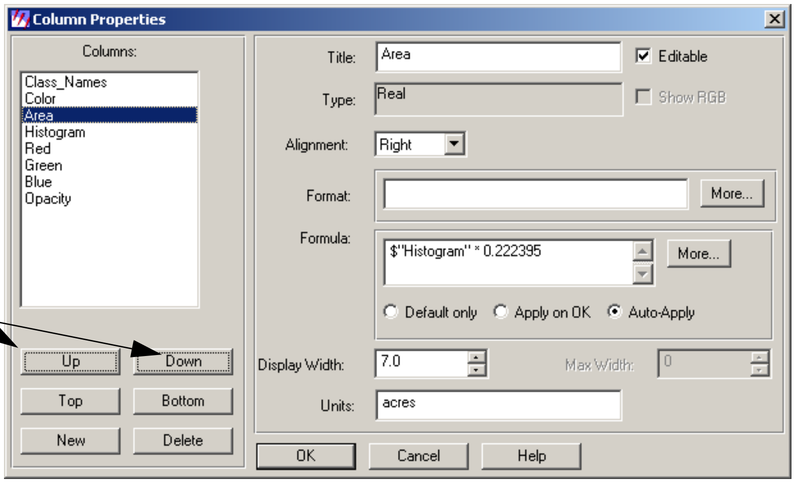
2. Select **acres** from the **Units** dropdown list and click **OK** to dismiss the Add Area Column dialog.

   The **Area** column is added to end of the Raster Attributes CellArray.

3. Select **Edit -> Column Properties** from the Raster Attribute Editor menu bar.

   The Column Properties dialog opens.

Use the Up and Down buttons to rearrange columns

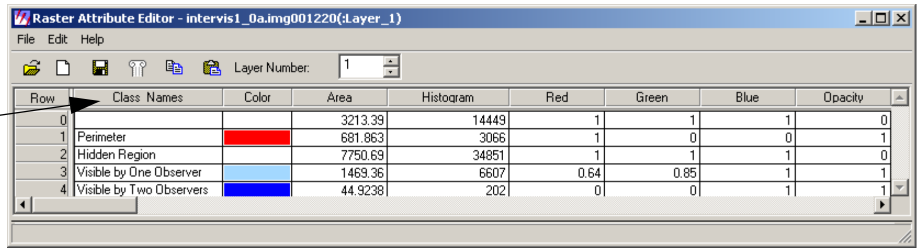


4. In the **Columns** field, select **Histogram**, and click the **Up** button four times to move it below the **Color** column.

5. Now select **Area**, and click the **Up** button until it is between **Color** and **Histogram**.

6. Click **OK** to apply these changes to the CellArray. The Column Properties dialog closes.

Columns are displayed in the new order



7. Select **File -> Save** in the Raster Attribute Editor to save all edits to the CellArray.

   You can now easily view the size and location of visible and hidden areas in the viewsheds.

Query the Viewshed Layer

1. Click an area inside the Viewer. The corresponding class is highlighted in the CellArray of the Raster Attribute Editor dialog.
2. When you complete your query of the data, select **File -> Close** in the Raster Attribute Editor to dismiss the dialog.

Finish

1. Click **Close** in the Viewshed dialog.
2. Select **File -> Close** in the Viewer.
3. Select **File -> Close Image Drape** in the Image Drape viewer.

Index

Numerics
3D Surfacing dialog 78
3X3 Edge Detect 35
3X3 Edge Detect dialog 36

B
Bicubic Spline 58
Bilinear Interpolation 58
Brightness Inversion dialog 41

C
Camera Model 57
Chip Extraction Viewer 64, 71
Circular Mask dialog 15
Convolution dialog 34
Crisp dialog 37
Cubic Convolution 58

D
Data Preparation menu 78
Dialog xxi
- 3D Surfacing 78
- 3X3 Edge Detect 36
- Brightness Inversion 41
- Circular Mask 15
- Convolution 34
- Crisp 37
- Filter Options 19
- Fourier Transform 3
- GCP Tool Reference Setup 70
- Geo Correction Tools 62
- IHS to RGB 49
- ImageInfo 75
- Import Options 79
- Indices 47
- Inverse Fourier Transform 10
- Job Status 36
- Low/High Pass Filter 7
- Open FFT Layer 5
- Projection Chooser 68
- Read Points 78
- Rectangular Mask 16
- Reference GCC File 71
- Resample 73
- RGB to IHS 48
- Save Layer As 9, 21
- Select Layer To Add 1, 36, 42, 82
- Set Geometric Model 62
- Surfacing 81
- Tasseled Cap 44
- Tasseled Cap Coefficients 45
- Wedge Mask 18

E
Enhancement
- radiometric 40
- spatial 33
- spectral 44

ERDAS Field Guide 76
ERDAS IMAGINE icon panel xiii

F
Filter 35
Filter Options dialog 19
Fourier Analysis menu 3
Fourier Editor 4
Fourier Transform
- create 1
- Editor 1
  - start 4
  - using toolbar icons 19

Fourier Transform dialog 3

G
GCP Tool 71
GCP Tool Reference Setup dialog 70
Geo Correction Tools dialog 62
Geometric correction 61
Georeferencing 57
Graphical model 38
- edit 39
- view 38

H
High-Pass Filter icon 20

I
Icons
- High-Pass Filter 20
- Image Interpreter 3, 27, 33
- Low-Pass Filter 20
- Open 42
- Run 10
- Viewer 36

IHS to RGB 48, 49
IHS to RGB dialog 49
Image
- invert 41
- reverse 41

Image Interpreter 25
Image Interpreter icon 3, 27, 33

Image Interpreter menu 3, 27, 34
ImageInfo dialog 75
Import Options dialog 79
Index 47
Indices dialog 47
Inverse Fourier Transform dialog 10

J
Job Status dialog 36

K
Kernel 35
    CellArray 36
    library 35

L
Level of Detail 100
Low/High Pass Filter dialog 7
Low-Pass Filter icon 20

M
Map projection 57
Menu
    Fourier Analysis 3
    Image Interpreter 3, 27, 34
    Radiometric Enhance 40
    Session xiii
    Spatial Enhancement 34
    Spectral Enhancement 44
    Tools xvii
    Utilities xviii
Mineral ratio 48
Model Maker 25, 38

N
Nearest Neighbor 58

O
On-Line Help xx
Open FFT Layer dialog 5
Open icon 42
Orthorectification 57

P
Preference Editor 29
Preview chip pane xxi
Projection Chooser dialog 68

Q
Quick View menu 42

R
Radiometric Enhance menu 40
Read Points dialog 78
Rectangular Mask dialog 16
Rectification
    image to image 57
    steps 57
Reference GCC File dialog 71
Resample 58
    Bicubic Spline 58
    Bilinear Interpolation 58
    Cubic Convolution 58
    Nearest Neighbor 58
Resample dialog 73
RGB to IHS 48
RGB to IHS dialog 48
Run icon 10

S
Save Layer As dialog 9, 21
Select Layer To Add dialog 1, 36, 42, 82
Session menu xiii
Set Geometric Model dialog 62
Space resection 57
Spatial Enhancement menu 34
Spatial Modeler 25
Spatial Modeler Language 25
Spectral Enhancement menu 44
Subset 26
Surfacing dialog 81

T
Tab 2
Tasseled Cap Coefficients dialog 45
Tasseled Cap dialog 44
Tasseled Cap transformation 44
Tools menu xvii

U
Utilities menu xviii

V
Viewer
    Chip Extraction 64, 71
Viewer (ERDAS IMAGINE)
    split 42
Viewer icon 36
Viewshed Analysis 99
Viewshed dialog 102, 104
viewshed layer 104, 105

W

Warning box 74
Wedge Mask dialog 18